WINTER '67 HIVER

CANADA AGRICULTURE

MINISTER, HON. J. J. GREENE, MINISTRE ■ DEPUTY MINISTER, S. C. BARRY, SOUS-MINISTRE

JOURNAL OF THE CANADA DEPARTMENT OF AGRICULTURE
JOURNAL DU MINISTÈRE DE L'AGRICULTURE DU CANADA

"Canada Agriculture" is published quarterly by the Canada Department of Agriculture. Its purpose is to help keep extension workers and agri-businessmen informed of developments in research and other federal agricultural responsibilities as carried on by the various units of the Department.

Contributors, namely, professional personnel in the Department's Research, Economics, Health of Animals, and Production-Marketing Branches, Special Act Administrations (PFRA, etc.), and the Farm Credit Corporation are invited to submit their articles in either English or French.

Contributions should be addressed to the Secretary, Editorial Board, Information Division, Canada Department of Agriculture, Ottawa.

«Canada Agriculture», publié par le ministère de l'Agriculture du Canada, paraît tous les trois mois. Ce journal a pour objectif de renseigner sur l'activité des Directions du ministère, les agronomes et les hommes d'affaires intéressés à l'agriculture.

Nos collaborateurs, du personnel professionnel des directions de la recherche, de l'économie de l'hygiène vétérinaire et de la production et des marchés, de l'administration des lois spéciales (ARAP, etc.) du Ministère ainsi que de la Société du crédit agricole peuvent, à leur gré, soumettre des articles en anglais ou en français.

Adresser toute communication au secrétaire du Comité de la rédaction, Division de l'information, ministère de l'Agriculture du Canada, Ottawa.

CANADA AGRICULTURE

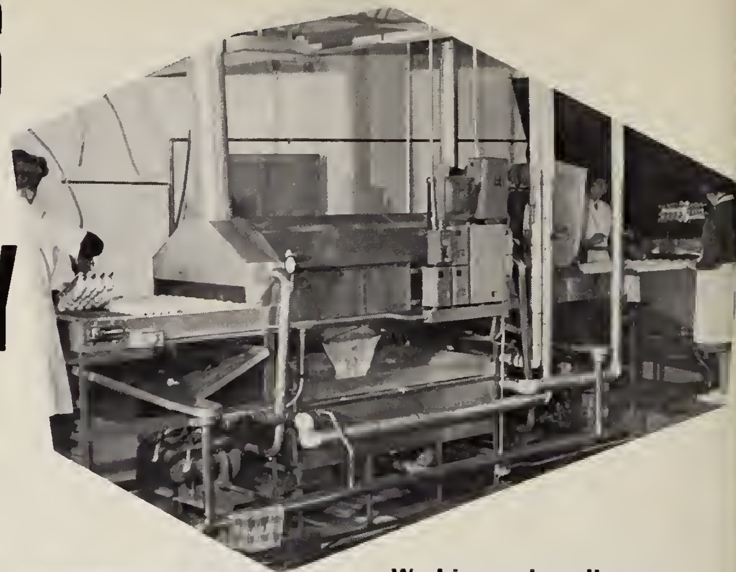
JOURNAL OF THE CANADA DEPARTMENT OF AGRICULTURE - OTTAWA
JOURNAL DU MINISTÈRE DE L'AGRICULTURE DU CANADA - OTTAWA
MINISTER, HON. J. J. GREENE, MINISTRE   DEPUTY MINISTER, S. C. BARRY, SOUS-MINISTRE

Page

VOL. 12 WINTER 1967 NO. 1
VOL. 12 HIVER 1967 N° 1

CANADA'S POULTRY INDUSTRY 1976

Chicken broilers



Washing and grading eggs

Bronze turkey flock on range

F. E. PAYNE

Changes that will occur in Canada's Poultry Industry in the next decade will be partly determined by changes in the demand for poultry products. The most important factor in shaping the total demand for poultry products to 1976 will be (1) human population, (2) price, (3) consumer income, and (4) consumer preference.

Canada's population by 1976 will be about 24 million, 4.4 million more or 22 per cent larger than last year. Poultry prices during the next ten years will likely retain and may further improve their competitive position in relation to other protein meat foods. Consumers by 1976 will have more money to spend than is the case today. Product preference among consumers is directly related to quality and to living habits, and changes in the latter factor have had some adverse effects upon the demand for eggs. It is frequently suggested that fewer breakfasts and less home baking have reduced per capita egg consumption. Availability and price of red meats will have a direct bearing on demand for poultry meat. How will prospective changes in these factors affect the production and consumption of poultry products by 1976?

EGG PRODUCTION 1976

In the last 10 years the rate of lay per bird has increased from 180 eggs per bird to 200, a total of 20 eggs per bird more. While this was going on the number of layers dropped from 27.1 million to 26.1 million or one million less hens. It is anticipated that by 1976 each bird will produce 215 eggs; this increased laying flock productivity coupled with a possible decrease of 5 eggs per capita consumption will slow growth in this sector of the industry.

Although total egg consumption by 1976 will be about 504 million dozen, up 20 per cent from 1965, higher flock productivity will limit expansion of hatchery sales of pullet replacements. An egg type chick hatch of about 60 million chicks by 1976 up from 47.3 million will likely fill the demand for market egg layers. This will require 77 million hatching eggs and 750,000 breeder hens to produce them. This is 220,000 less hatching egg producing hens than last year. This large decrease is accounted for by two facts, firstly, these birds will lay more eggs, but more important the three or four month hatchery supply flocks will disappear in favour of breeder flocks pro-

---

Mr. Payne is Chief, Markets and Merchandising, Poultry Division, CDA Production and Marketing Branch, Ottawa. This article is an excerpt from a paper he gave recently to the annual convention of the Canadian Hatchery Federation.

ducing most of the year. We should, therefore, require about 23 per cent less hatchery supply flock hens ten years from now.

CHICKEN BROILERS 1976

It is anticipated that by 1976 the per capita consumption of chickens will rise to about 32 pounds compared with 26 pounds last year. On top of this we will have an additional 4 million people to feed. This then means that there will be 690 million pounds of chicken required as compared to 443 million last year.

What does this mean to the hatcheryman? You will have to meet the demand for 230 million broiler chicks an increase of 66 per cent over last year's 138.4 million. This will, in turn, mean you must place 315 million hatching eggs into your incubators as compared to 186.3 million last year. An increase of 69 per cent. Furthermore, you will require an additional one million broiler hatching egg producing hens to bring the total up to 2,300,000 from last year's 1,300,000.

TURKEYS 1976

The rate of increase of turkey production in Canada, over the next ten years, will probably average at least 7 per cent per year. About 2 per cent will be the result of population increase, and about 5 per cent as a result of increasing per capita consumption of turkeys.

If beef and pork prices in Canada continue at near their present levels relative to turkey prices, then a further rise per capita use of turkey seems assured. The strong outlook for cash sales of wheat and feed grains in Western Canada has raised beef and hog feeding cost to a greater extent than the increase in poultry feeding costs. Consequently, fed cattle and hog production in Canada are slowing down, relative to a continuing expansion in poultry meat production. Relatively lower consumer price levels for turkeys and chickens will result in a stronger demand for these products and poultry meat producers appear prepared and willing to satisfy the growing market needs.

A large part of the increased consumption of turkey that has occurred has been due to the production and availability of broiler weight birds. In the 1961-65 period, turkey consumption during the January to September period was 47 per cent of the annual total, compared with 42 per cent for the 1956-60 period and was only 35 per cent during the 1951-55 period. This trend will continue during the next ten years.

The prospect for increased sales in the area of further processing, that is, turkey parts, roasts, steaks, rolls, etc., appears very good. One of the main drawbacks in developing efficient merchandising programs to promote the new products, is general ignorance of consumer attitudes and preferences toward meat, and particularly towards turkeys and turkey products. The need is stressed for relevant consumer research to direct merchandising programs rather than the hit and miss methods that are currently used.

Seasonality of production in turkeys will become less marked because turkey broilers will continue to constitute an increasing proportion of total production. In 1965, broilers made up 18 per cent of the total production compared with only 10 per cent in 1961. This trend will continue.

Turkey poult production by 1976 will likely grow to 29 million, up 76 per cent from the 16.5 million poult hatch in 1965. Expansion will likely continue to be most rapid in turkey broiler production. Broiler turkey slaughterings in registered stations in 1965 totalled 6.2 million birds and represented 50 million pounds, equivalent to about 2½ pounds per capita. Per capita consumption of heavyweight birds in 1965 was 7 pounds, accounting for 8.2 million birds.

By 1976, per capita turkey consumption will probably rise to about 13.5 pounds from 9.5 pounds last year. Per capita turkey broiler consumption will likely double and developments in further processing will expand the demand for heavies. On this basis, turkey broiler production will grow to about 15 million birds by 1976 while the production of heavies will rise to 12 million.

Corresponding expansion will be necessary in the turkey supply flocks to meet the increased demand for hatching eggs. The Canadian hatcheryman will have to meet the demand for 29 million turkey poults ten years from now. This will probably consist of 16 million broiler type and 13 million heavy weight type an increase of 108 and 46 per cent respectively. Additional seasonal exchange of turkey hatching eggs is anticipated across the 49th parallel.

To fill the demand you will have to place in incubators 25 million broiler type hatching eggs and 22

million heavy type eggs. This will in turn require turkey hatchery supply flocks containing 195,000 broiler type turkey hens as against 85,000 last year and 440,000 heavy type hens compared to 280,000 in 1965.

Now that I have stuck my neck out this far I grow alarmed that some of you might not still be around in ten years to prove me wrong. So—just to be fair about it and to give most of you a crack at me, I have included in the tables at the back of my prepared speech a further projection for all poultry products for a period 5 years hence, 1971, as well as 10 years from now 1976.

PRODUCTION & MARKETING DEVELOPMENTS

The developments that will occur in the area of production and marketing organizations within the turkey and chicken broiler industry cannot be more than surmised. Speculation on these matters is particularly hazardous because political as well as economic and technological considerations are important. However, it would appear that a few private marketing organizations, embracing breeder flocks, hatcheries, feed suppliers, growers, processors, etc., will control a major share of the marketing volume in turkeys and chicken meat. The role of the grower in that industry set up will be more closely planned and regulated than has been the case in the past. It would seem possible that growers will retain ownership of the major portion of the production facilities, but they will be planning their production in consultation with their marketing organization.

Whether the negotiations between the turkey grower and his marketing organization will be on an individual basis, as at present, or on a collective basis as proposed by marketing board exponents, remains to be seen. However, the marketing set up of the future will be more closely co-ordinated with consumer demand than has been the situation in the past.

As I gaze into my crystal ball I see two basic ingredients emerging which are essential to your industry. One is knowledge and management skill. The increasingly complex economic system of our country will demand an exactness and precision of knowledge and a willingness and ability to apply it that was not required heretofore. The second essential ingredient is the striking of a reasonable balance of strength between the various segments of the industry.

It must be realized that no industry with so many links in it as the poultry industry has can prosper in the long run if any single link is persistently weakened. This applies to everyone, the retailer, the processor, the hatchery, the feed dealer, the grower and the producer of chicks and hatching eggs, etc., down the line. This is required in the long-run self-interest of the whole industry.

The ability to organize from market strength and to work in harmony towards alleviating the pressures in your market is truly the great challenge facing the poultry industry and its breeders today and ten years from now. We look for further competition developing between feed manufacturers and independent integrators in the egg, turkey and broiler industries. This will be done through horizontal and vertical integration unless you form your own marketing groups, amalgamate or merge, or otherwise move into economic concentration of production and sales power. We predict the independent operator will have to take one of these lines of approach, they will have to merge for strength. We look for more integration before we have less.

One thing that has already become apparent to you I am sure in the broiler and turkey industry, I think you can also see evidence of it becoming equally true in the egg industry, is that the feed dealer is getting further and further into all aspects of the poultry business. There has been a trend among major feed manufacturers towards acquiring at least controlling interests in hatcheries and processing plants, in all but the feeder level. It is felt that this is but another step towards total integration in the sense that the larger feed manufacturers will eventually also work at the wholesale merchandising level.

But where does this lead the independent operator? If you do not wait too long and if you can profit by the experience of other types of businesses that have gone through the same growing pains, you are facing a very challenging opportunity. The answer lies in doing what your competition is doing, only just a little bit better perhaps in a slightly different way. There definitely is room for the little fellow and better yet a combination of little fellows. The larger indedependents will probably have to combine forces. For

TABLE 1—ESTIMATE OF LAYER NUMBERS REQUIRED TO MEET EGG CONSUMPTION PROJECTIONS FOR 1971 AND 1976

	Canada's popula- tion	Per Capita Egg Con- sump- tion	Total Con- sump- tion	Pro- duction per Layer	Layer Numbers
	million	eggs	million dozen	eggs	million
1965	19.6	257	419	200	26.1
1971	22.1	255	470	210	26.8
1976	24.0	252	504	215	28.2
% change 1976/65	22	−2	20	8	8

TABLE 2—ESTIMATE OF CHICKEN PRODUCTION, BY CLASS, REQUIRED TO FILL CHICKEN CONSUMPTION PROJECTIONS FOR 1971 AND 1976

	Canada's Popula- tion	Per Capita Con- sump- tion	Consumption			Production	
			Total	Chickens	Fowl	Chickens	Fowl
	million	lbs	million lbs eviscerated weight basis			million birds	
1965	19.6	26.0	510	433	77	138.4	20.7
1971	22.1	30.0	663	590	73	200.0	22.0
1976	24.0	32.0	768	690	78	230.0	23.0
% change 1976-1965	22	23	50	59	1	66	11

TABLE 3—ESTIMATE OF TURKEY PRODUCTION, BY CLASS, REQUIRED TO FILL TURKEY MEAT CONSUMPTION PROJECTIONS FOR 1971 AND 1976

	Canada's Popula- tion	Per Capita Con- sump- tion	Consumption			Production	
			Total	Broiler	Heavies	Broiler	Heavies
	millions	lbs.	million lbs. eviscerated weight basis			million lbs.	
1965	19.6	9.5	187	50	137	6.2	8.2
1971	22.1	12.0	265	95	170	12.0	10.0
1976	24.0	13.5	325	120	205	15.0	12.0
% Change 1976/65	22	42	74	140	50	142	46

him there will be no middle ground. Your security lies in collective action. Select your own type of collective action, such as integration, merger, cooperative sales organization. Call it what you wish as long as your collective action fills the need for increased capital, buying power, upgrading of management and gains through market strength as well as reducing operating costs. Don't wait to merge until you have to. Choose your partner carefully and combine your assets. Choose carefully a single marketing agent. There can only be one boss and that is the marketer.

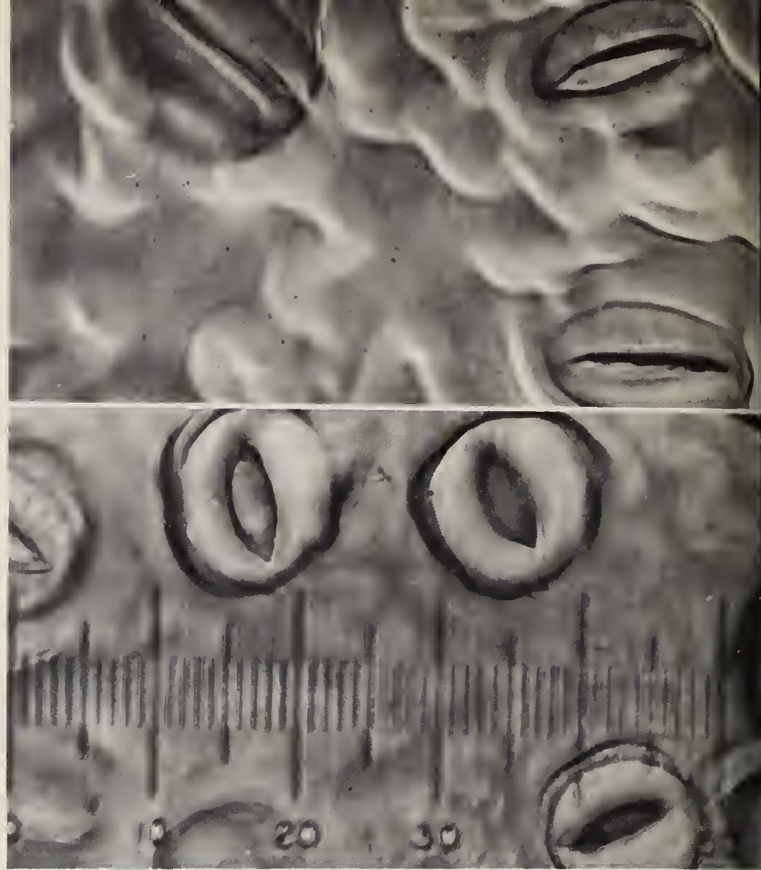
The long range picture shows that our broilers, eggs and turkeys continually will buy less pounds of feed per market dollar. You may have to merge with other segments to survive, or bring supply and demand under your control.

One last word in this regard and that is efficiency. There will be no place in the future for inefficient operations be it at the producer, hatchery or processor level. Inefficient units will perish. There is plenty of evidence that the forces at work today in the poultry industry are pushing you all towards larger scale and more efficient operations.

To summarize may I say—in considerable measure the scale of your operations is being dictated by the scale of operations of the food retailers and the industry's need to come up with a unit of countervailing size. To take full advantage of the situation fewer but larger units will emerge, perhaps by process of elimination or combination. The larger units will attract into the industry new talent and new money. The processor is the kingpin in the chain of command throughout the poultry industry today. To be more fully effective he is increasing his scale of operations to a scale more in keeping with that already in being at the food retailer levels and he is devising new markets and strategy.

You must all take fuller and quicker advantage of the rapidly developing technology. You must further adopt rigid controls of planning and rational fulfilment of consumer needs. These proven devices should make it possible to avoid pitfalls in the road ahead. To achieve this a high degree of efficiency will be necessary in all segments of the poultry industry.

I am confident that with foresight, planning and a full recognition of the industry's needs the poultry industry of this country will go forward to bigger and better things.



SOIL MOISTURE
FOR CROP PRODUCTION

J. M. FULTON

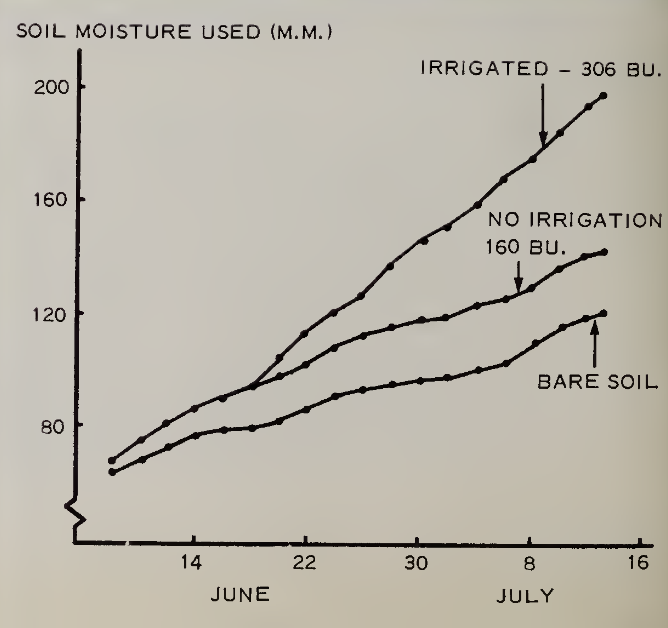
Plants use between 10 and 20 tons of soil moisture from each acre of cropped land almost every day of the growing season. The water is obtained from the reservoir of moisture stored in the soil and includes some water that is evaporated directly from the surface of the soil as well as that transpired from the foliage. Maximum crop yields are obtained only if the soil moisture supply is replenished, by rainfall or irrigation, before the soil dries out sufficiently to restrict plant growth.

Seasonal rainfall in southwestern Ontario is almost always inadequate to produce maximum yields of shallow rooted crops grown on sandy soils. In some seasons, supplementing rainfall with irrigation water has doubled the yield of cucumbers and tripled the yield of potatoes. Occasionally yield increases from irrigation are small but the average yield of irrigated potatoes, grown on fox sandy loam soil, over a period of 11 years was 317 bushels per acre compared with 195 bushels where the crop was not irrigated. Maximum crop response to irrigation water can be obtained only if the correct amount of water is applied at just the right time. In practice, the optimum irrigation schedule varies with the crop species, the soil type and the meteorological environment.

From our experiments at Harrow we have been able to provide effective irrigation schedules for potatoes and cucumbers (see table) grown on some of the sandy soils of the district. Similar information is needed for other crops and the necessary data is gradually being accumulated. In addition we are, currently, making a careful study of the factors that influence the amount of water used each day, examining the possibility of reducing the amount of water needed to produce a crop and attempting to improve the efficiency of irrigation water by tailoring management practices specifically to the irrigated crop.

CORN CROP STUDIED

It is common knowledge that the yield of shallow rooted crops grown on sandy soils of this area, according to accepted management practices, is increased by irrigation. It is generally believed that deeper rooted crops such as field corn meet their needs by contacting a greater volume of soil moisture and therefore are less responsive to irrigation. In 1965, our research revealed that corn plant populations of 16,000, 22,000, and 28,000 plants per care produced yields of 111, 104, and 98 bushels per acre respectively. When irrigated, however, these populations gave yields of 149, 177, and 175 bushels of dry



Dr. Fulton is Head, Soil Science Section, CDA Research Station, Harrow, Ont.

Photomicrograph (X520) of stomata from potato leaves:
Top: closed by treating with chemicals
Bottom: open from untreated plots

shelled corn per acre respectively. This points to the possibility that crop management, with respect to the number of plants per given area for unirrigated crops, may not be the best when the same crops are irrigated. The deep-rooted nature of the corn crop was reflected in the fact that the interval between applications of water could be extended to 18 days as compared to 7 days for potatoes grown on the same soil. The corn crop used about 3.6 inches of water in 18 days so that if rainfall during the 18-day period was less than 3.6 inches the difference should be made up by irrigation water.

POTATO CROP EXPERIMENT

We used lysimeters to measure the amount of water lost from the soil each day. In 1965 an irrigated potato crop used nearly 8 inches of water and produced 306 bushels of marketable-size tubers per acre (see figure 1). The unirrigated crop used about 6 inches of water and produced 160 bushels of potatoes. The difference (about 2 inches) all occurred during the last three weeks of the growing season, showing that a shortage of soil moisture during this period greatly reduced yield. It is interesting that water loss from bare soil (no crop grown) was almost 5 inches, suggesting that substantial water loss can occur by evaporation from the surface of bare soil exposed between crop rows. Thus it appears if practical techniques were developed to eliminate such losses, the amount of irrigation water needed could be greatly reduced, and, under some conditions, possibly eliminate the need for irrigation.

In our investigations, we also found that the moisture content of the soil had little effect on evapotranspiration rate until 1.0 inch of water had been removed from soil storage. During this time, the amount of water used in a day depended upon the size of the plants and the evaporative demand of the atmosphere. After one inch of water had been removed from soil storage, we discovered that evapotranspiration was kept low by the shortage of moisture in the soil and plant size or evaporative demand by the atmosphere had little effect. Actual evapotranspiration can be estimated from evaporation measurements provided that a correction is included for soil moisture content (especially in dry periods) as well as a correction for plant size.

It is generally assumed that much of the water transpired from plants passes through the stomata of the leaves in the vapor form. Recently, chemicals such as alkenyl succinic acids have become available which make it possible to control the size of the stomatal opening. It follows that transpiration should be reduced if stomatal size is reduced. If the reduction in transpiration can be achieved without reducing crop yield, soil moisture will be conserved and the amount of irrigation water and frequency of application will be reduced. It is conceivable that in some climates the need for irrigation could be eliminated entirely. Because supplies of irrigation water are not always available, and the costs of distribution systems and water applications are high, any method of conserving soil moisture so as to reduce the need for irrigation warrants study. In 1965, we found that stomatal control chemicals applied to potato foliage reduced stomatal aperture from 2.57 to 1.85 microns (see figure 2) but evapotranspiration from treated and untreated plants was almost identical. Several explanations for the failure to reduce evapotranspiration in these experiments are possible, (a) a large part of the water lost from the soil may have evaporated directly from the soil surface (b) some of the water transpired from the plant may have passed through the epidermis rather than the stomata (c) further reduction in stomatal aperture may be necessary or (d) some factor other than stomatal aperture may have controlled transpiration in these experiments. The practical value of stomatal control chemicals as an aid to crop production remains unknown until these possibilities are thoroughly investigated.

Production of some of our deep-rooted field crops, currently considered to produce optimum yields without irrigation, may in the future be increased by adoption of management practices developed specifically for and used in combination with irrigation. Our investigation of these possibilities is continuing.

TABLE 1—IRRIGATION SCHEDULES FOR POTATOES AND CUCUMBERS

Soil Type	Inches of water needed*		Days between applications	
	Potatoes	Cucumbers	Potatoes	Cucumbers
Fox sandy loam	1.0	1.3	7	11
Harrow sandy loam	1.2	1.5	8	13
Berrien sandy loam	1.3	1.6	9	14
Tuscola fine sandy loam	1.5	1.8	10	15

* Includes rainfall and irrigation water.

DES PORCS SAINS POUR LA RECHERCHE

C. L'ÉCUYER

Pour mener à bien nos travaux de recherches sur les maladies du porc nous avons entrepris, dès 1961, l'établissement d'un troupeau de porcs exempts de certaines maladies afin d'avoir à notre disposition des sujets sains. Il était évident, à ce moment-là, que la population porcine de notre région et aussi celle du pays entier, souffrait non seulement des maladies aiguës bien connues (érésypèle, salmonellose, encéphalites) mais également d'un nombre de maladies chroniques insidieuses (rhinite atrophiante, pneumonie enzootique et infection à entérovirus). La présence quasi universelle de ces maladies chroniques rendait les porcs commerciaux inutilisables pour fins de recherches sur les maladies puisque les résultats obtenus à la suite d'infections expérimentales étaient presque toujours compliqués par la présence d'autres maladies secondaires.

Ces maladies chroniques, telles la rhinite atrophiante infectieuse, causent indirectement de la mortalité dans nos troupeaux mais elles sont aussi responsables d'une diminution marquée du rythme de croissance des animaux infectés. Nous ne disposons, à date, d'aucune méthode permettant de diagnostiquer avec certitude la présence ou l'absence de ces maladies chez le porc vivant.

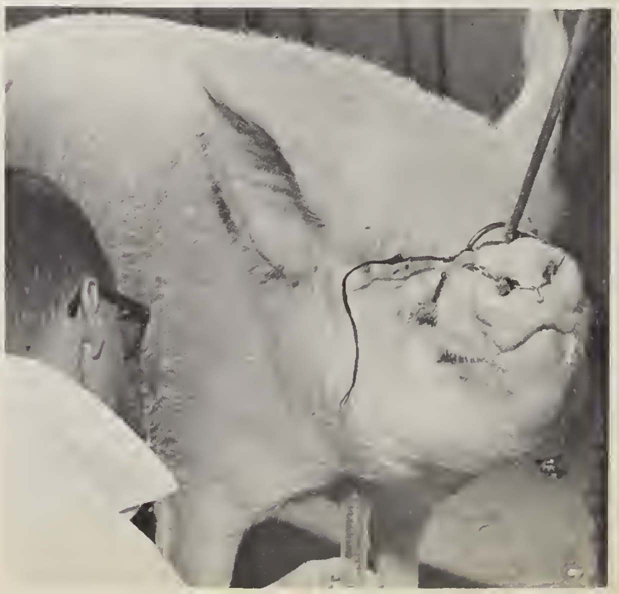
Nous savons toutefois que ces maladies sont transmises: (1) dès la naissance, de la truie à sa portée; ou (2) au moment du sevrage, de portées infectées aux portées indemnes. Armés de la connaissance que ces maladies chroniques sont transmises après la mise-bas, il est évident que nous pouvons briser le cycle de transmission de l'infection de la truie aux porcelets en obtenant les porcelets avant la naissance normale, et en les élevant en quarantaine absolue, isolés de tout autre porc.

L'auteur est un médecin vétérinaire, attaché à la Division de la Pathologie animale à Hull, Québec.

La méthode que nous avons utilisée à l'Institut de Hull consistait à obtenir les porcelets par césarienne deux ou trois jours avant la date prévue de la mise-bas naturelle. Nous avons accompli, de cette façon, quelque trente césariennes sur des truies de première ou de deuxième portée. Dès la naissance nous transportons les porcelets dans des chambres d'isolement désinfectées où ils sont placés dans des cages individuelles pour y demeurer pendant deux à trois semaines. Ces cages sont maintenues à une température élevée (95°F) et fournies d'un approvisionnement d'air chauffé et stérilisé.

Les rations que nous servons à l'Institut sont soit à base de lait de vache avec compléments minéraux et vitaminiques, soit des succédanés commerciaux de lait (SPF-Lac, Borden). Le porcelet reçoit trois repas par jour et la quantité fournie varie selon la grosseur et la vigueur de chaque individu. Après une dizaine de jours nos porcelets reçoivent peu à peu dans le lait, des aliments solides, en général une moulée pré-début en granulés. La moulée pré-début remplace graduellement le lait et le sevrage est complété dans trois ou quatre semaines. Vers l'âge de deux semaines, nos porcelets sont transférés à une chambre d'élevage en commun. Les porcelets sevrés sont gardés dans la porcherie qui avait été au préalable vidée, désinfectée et remise à neuf.

Le porcelet prélevé par césarienne et élevé en quarantaine ne reçoit pas comme son congénère élevé de façon naturelle, le colostrum (premier lait) de la truie et ne possède donc pas dès les premières heures de la vie les anticorps fournis normalement par la mère. Ces porcelets sont très susceptibles aux infections les plus banales (en particulier les entérites) et demeurent tout au long de leur vie plus susceptibles que les porcs conventionnels aux infections bactériennes communes auxquelles sont exposés tous les animaux. C'est pourquoi nous devons fournir à ces porcelets une protection mécanique (cage et alimentation stérile) afin de réduire autant que possible les



risques de contamination bactérienne jusqu'au moment où les porcelets puissent eux-mêmes produire des anticorps (protection biologique). L'élevage de ces porcs présente donc certaines difficultés, par contre leur haute susceptibilité les rend d'autant plus utiles comme sujets d'infections expérimentales. Notons que le porcelet dépourvu de colostrum nous a servi de sujet expérimental unique pour l'étude des phénomènes immunologiques, c'est-à-dire le développement des anticorps chez les animaux, sous l'effet de diverses infections.

La majorité des porcelets produits par césarienne ont servi directement dès le jeune âge aux études expérimentales de certaines maladies, en particulier des encéphalites virales et des infections à entérovirus porcins. Les autres porcs prélevés par césarienne ont formé les fondations d'un troupeau qui compte aujourd'hui une trentaine de reproducteurs. Parmi ces reproducteurs, il reste après trois années, quelques sujets de première génération, c'est-à-dire des porcs prélevés par césarienne, mais la plupart des animaux sont des descendants de deuxième ou troisième génération nés toutefois de truies prélevées par césarienne. Les procelets produits par ces truies de deuxième ou troisième génération reçoivent après la naissance naturelle, le colostrum de leur mère et sont pour cela des sujets tout à fait normaux possédant un niveau de résistance normale aux contaminations bactériennes naturelles. Ces porcs élevés en quarantaine demeurent exempts des maladies chroniques répandues dans le cheptel porcin et sont une aide indispensable à nos travaux de recherches sur ces mêmes maladies chroniques.

Le repeuplement de troupeaux commerciaux au moyen de porcs exempts de maladies[1] a connu un moment de popularité dans l'industrie porcine. Toutefois le repeuplement de troupeaux à partir de porcs de première génération (prélevés par césarienne) s'est avéré une méthode trop difficile et dispendieuse. Le repeuplement de troupeaux commerciaux au moyen de porcs exempts de maladie, de deuxième ou troisième génération utilisant dans la plupart des cas des truies gestantes est une méthode pratique qu'on peut appliquer économiquement au sein de l'industrie porcine canadienne.

Un troupeau établi de cette façon et maintenu sous une quarantaine rigide, demeurera exempt des maladies chroniques respiratoires (pneumonie-rhinite) et par surcroît de bien d'autres infections communes telles la gale sarcoptique, les vers ronds et certaines entérites. Il est également évident que le niveau de production de ce troupeau sera influencé par la qualité de la régie hygiène, habitation, nutrition appliquée. Toutefois les porcs exempts de maladies pourront résister plus facilement aux mauvaises conditions que le porc conventionnel qui doit subir en plus les assauts des infections qu'il porte.

Nous utilisons continuellement, à l'Institut de Recherches sur les Maladies Animales, les porcs exempts de maladies, issus de notre troupeau. Ces porcs nous ont été d'une aide indispensable dans les études sur les encéphalites à virus des porcelets et nous servent également dans nos études sur la pneumonie enzootique (pneumonie à virus) et sur les maladies de la peau, en particulier l'épidermite exsudative du porc.

Au point de vue dépistage des maladies qui se présentent dans le cheptel porcin, tout particulièrement de la peste porcine (choléra du porc), les porcs exempts de maladies sont très utiles puisqu'ils sont: (1) une source de tissus normaux pour permettre l'isolement *in vitro* des virus; (2) une source de sérums normaux, exempts d'anticorps compliquants; et (3) une source d'animaux sains servant au diagnosticien pour examiner les résultats de l'infection expérimentale sans devoir tenir compte de maladies qui n'ont en effet rien à voir avec le matériel inoculé.

RÉSUMÉ

Le porc exempt de maladies est essentiel à l'étude des diverses maladies du porc autant au point de vue diagnostic que des recherches expérimentales. A l'Institut, nous continuons nos expériences et nos recherches sur les maladies du porc en utilisant les porcs exempts de maladies chroniques en vue d'établir des méthodes de dépistage, de prévention et de traitement de ces mêmes maladies.

[1] La méthode est connue sous plusieurs noms: (1) porcs exempts d'organismes pathogènes spécifiques (EOPS) (traduction directe de l'expression «Specific Pathogen-free ou SPF» utilisée aux États-Unis), (2) porcs «exempts de maladies spécifiques» EMS, ou (3) porcs à maladies réprimées.

Extrême gauche—Prise de sang à la veine cave antérieure d'une truie exempte de maladies, en vue d'études immunologiques sur ses porcelets

Gauche—L'auteur avec un porc infecté de façon expérimentale avec l'épidermite exsudative

POTATOES: what affects distribution...

E. S. EATON

Potatoes can be grown, and are grown, in most of the settled areas of North America. The average total production in Canada and the United States for the five-year period, 1961-1965, amounted to 318 million hundredweight and occupied about 1.7 million acres. Over 75 per cent of these were fall crop potatoes, for a total of 242 million hundredweight using 1.3 million acres.

FALL CROP POTATOES

If you draw a line from West to East across the United States, about half way between the Canadian and Mexican borders, say along the 40th parallel, you will find that all States listed as fall crop States have at least part of their territory above that line. Practically all States above that line are listed as fall crop producers. Similarly, a line drawn to mark off the southern one-fifth of Canada will pass near Edmonton and you will find potato production almost entirely to the south of this line. In fact, if you move that line southward to include only the southern tenth of Canada, running through the southern tip of James Bay, most of the potatoes are produced south of that line. Thus, the principal potato areas lie within a few hundred miles on either side of the Canada–United States border.

If we subdivide this potato area we find that Canada, the Central fall crop States, the Eastern States, and the Western States produce 23, 25, 21 and 31 per cent, respectively, of the total North American potato crop. Of the Canadian production, 40 per cent comes from the Maritimes, about 20 per cent from each of Ontario and Quebec and about 20 per cent from the Prairies and British Columbia.

We have come a long way since the consumer grew his own potato requirements. Today, we have reached a stage where whole regions are either surplus or deficit in potatoes in terms of local consumption needs. The principal deficit areas obviously are those which contain the largest urban concentrations of population and these lie in the eastern part of the fall potato area. As a generalization, it is fair to say that most of the potatoes are obtained from producing areas which are relatively close to the consumption area. Potatoes are only moved long distances to supplement local supplies. This means that if local crops are unusually good, there is less demand for potatoes to move in from more remote areas. Because of the variability of yields and the seasonal pattern of production, even those areas which are consistently surplus producers require supplementary supplies at some season, and often from long distances. You will find California potatoes in New York, New York potatoes in Alberta, Prince Edward Island potatoes in Saskatchewan. You will even find Manitoba potatoes in Australia, depending on the year and the season.

In the United States, the five major potato producing areas are centered on California, Idaho, North Dakota–Minnesota, New York and Maine. These areas account for over 60 per cent of the total United States potato production. It has been estimated that 75 per cent of the United States population lies within 500 miles of one or more of these production centers. However, the regional share of the total potato production from each of these areas is not parallel to the share of population residing within 500 miles. The greatest disparity is for Idaho and New York. Idaho produces about 20 per cent of the potatoes and has under three per cent of the population close at hand. New York has 40 per cent of the total population within 500 miles and produces under eight per cent of the total potatoes. Although large metropolitan centers tend to draw the bulk of their potatoes from nearby production areas, it is evident that the large eastern urban centers must look further afield for their supplies. Also, the shorter the haul, the more likely that transportation will be by truck rather than rail. Recent studies have shown that potatoes are moved very long distances to serve the large metropolitan areas and that this movement is predominantly from West to East and from North to South. In Canada, Maritime potatoes move west toward Montreal and Toronto as well as toward southern markets. This is the only part of the North American potato distribution system where any large share of the production moves westward. Potatoes from New York and Maine move south in substantial quantity as far as Louisianna and Florida even though this means by-passing some of the large urban centers closer to the production areas with some of the potatoes. The largest market for potatoes from these areas is New York City but it does not take all their potatoes but instead draws potatoes in large quantities from as far away as California.

It is evident that a nearby market is not necessarily a captive market and most major markets are shared in various degrees by the various producing areas.

The author is an Economist with the Marketing and Trade Services Division, CDA Economics Branch, Ottawa, Ont. This article is based on a paper he gave recently to the Eighth Canadian Potato Industry Conference, "Distribution Pattern and Factors Affecting Distribution of North American Potatoes."

In Canada, there is also evidence of the interregional exchange of potatoes. For example, in the five years, 1961-1965, the major centers in Quebec received annually about half their total Canadian potato requirements from New Brunswick and about one quarter from each of Quebec and Prince Edward Island. At the same time, Quebec was the source for substantial quantities of potatoes moving to Ontario and some to Manitoba. Quebec centers also brought in potatoes from California, Florida, North Carolina, Virginia, Idaho and New York. Most of these imports were in the off-season for fall potatoes, being a supplementary source in the early summer when fall crop potatoes were scarce or poor in quality.

The largest source of Canadian potatoes for the Toronto market is Prince Edward Island, followed by local and New Brunswick production. It is not unusual for upwards of 100 carloads to be moved from Ontario to Nova Scotia, New Brunswick, Quebec and Manitoba in the early summer before local supplies are ready.

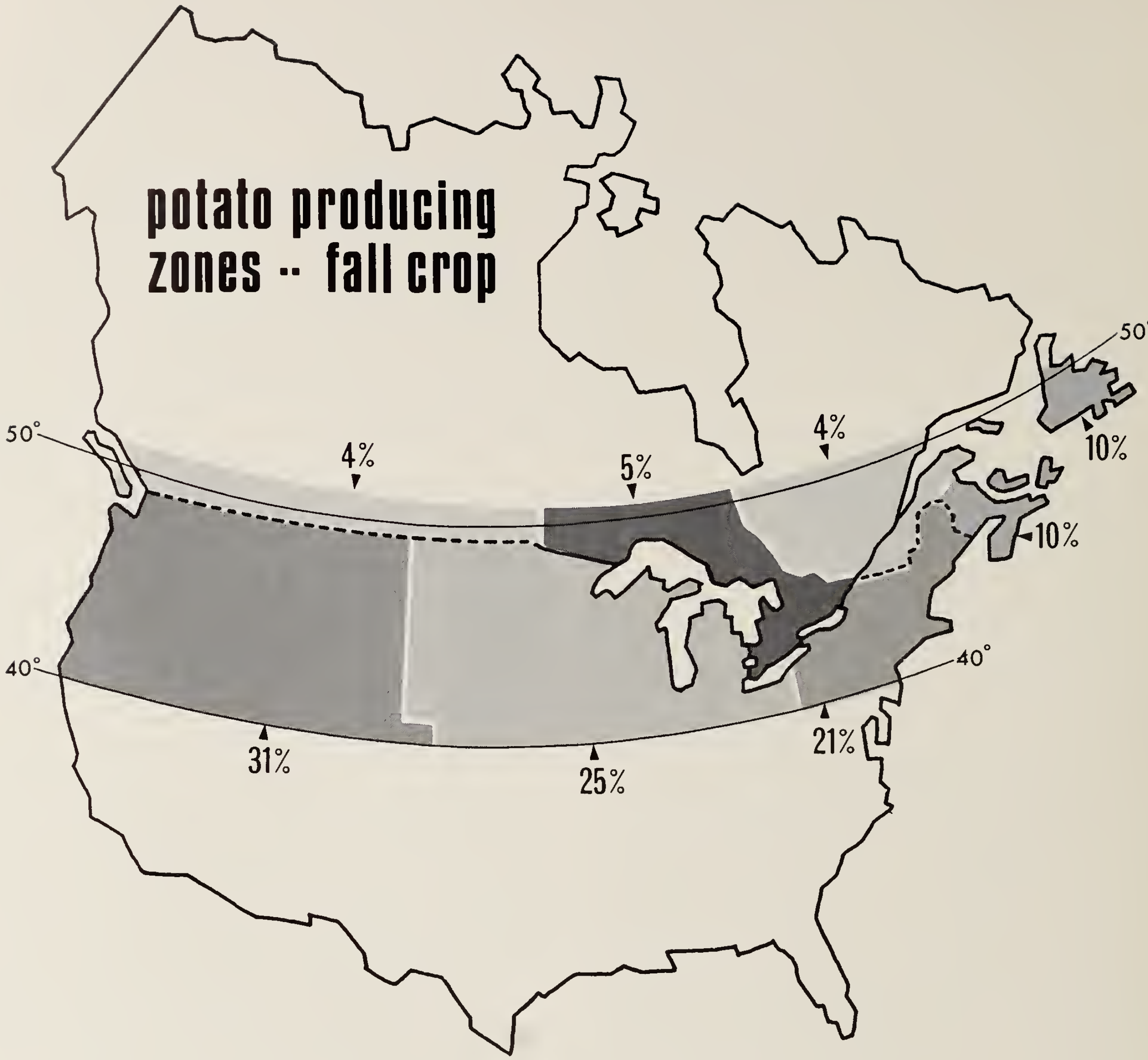
New technological developments have greatly expanded the potential movement of potatoes. Processed potatoes can move into markets where disease or pest control regulations may prevent the movement of fresh potatoes. Also, the cost of transportation for potatoes in concentrated forms is less, in terms of quantities ready to eat, than is the case for the more bulky fresh product. It is factors like these which permit Canadian potatoes to find their way into such markets as Great Britain or Australia. In addition, as the population of the far North increases, there is increasing demand for potatoes, first for concentrated or processed types and then for the fresh. Because the open navigation period is limited, supply ships to the Arctic must leave on their annual trip before the fall crop of potatoes is ready for harvest. Accordingly, in the past it was not physically possible to send fresh potatoes by ship and the cost of air freight for such a bulky commodity would be practically prohibitive except for an occasional luxury shipment of fresh potatoes as a special treat.

However, the picture has changed, now that atomic radiation equipment has been developed commercially in Canada that will inhibit sprouting and aid preservation of potatoes. For example, 1966 crop potatoes can be preserved until supply ships depart in early 1967 and still be delivered to Arctic destinations in good condition with a useful remaining storage life. It may come about that the extension of this process to larger quantities of fall crop potatoes, using this Canadian development, could remove the requirement for off-season potato production and permit the supply of a larger share of the total market from fall crop production areas. However, I doubt whether the fall crop will ever entirely replace the demand for some new potatoes at other seasons of the year.

Next, consider the relationship of crop volume in any year to prices and future plantings. The old rule of thumb for potato planting decisions, when the principal movement of potatoes was by sailing vessel along the Atlantic coast, was to "plant potatoes when they're cheap and sell them when they're high". The implication was that a large crop in a particular year led to plentiful supplies in the spring, with generally low prices. It was believed that this would discourage many farmers from planting as many potatoes in the ensuing year, and that this was the year for the smart farmer to increase his plantings. Conversely, a small crop in one year would lead to short supplies and high prices the following spring. These high prices would encourage increased plantings that year and resulting low prices. Accordingly, the smart farmer should turn his attention to alternative crops. The market tended to swing up and down according to a pattern of alternate years of good prices.

In recent years, however, this pattern of prices has not been apparent and good and poor price years tend more to run in cycles of two or even three years. The three years from 1962 to 1964 in Canada had below-average plantings. Plantings in 1965 were slightly above average but the yield was down and prices generally favorable. In 1966, we had acreages much above average in both United States and Canada. Compared with the combined U.S./Canada 1965 acreage, the increase in 1966 was about equal to the total potato acreage of the Maritime Provinces. This increase, compared with the 1961-1965 average acreage, is about one quarter larger. The total acreage of fall crop potatoes was about 10 per cent above that of 1965, or an increase of nearly 100,000 acres. With a good yield the supply should be high and price below those of recent years. If history repeats itself, there will be a further heavy planting of potatoes in 1967 and it will not be until 1968 that growers will be persuaded by unsatisfactory prices to cut back their plantings and leave a good price year for 1968-69 for the benefit of the stable volume producers.

It appears, however, that some growers still have a tendency to base their planting intentions on the price obtained from the previous crop. Hence, when the production of these growers is added to that of the more stable producers, there is, in the total, an effect similar to that obtained if all growers followed this practice, but to a more restrained degree. In examining the implications of this tendency, there are several significant points to be remembered. The U.S. Department of Agriculture has studied the relationship



of price to supply and demand in various regions and for the United States in total. It is assumed that the results may be generally applicable to Canada and to the North American potato industry as a whole. It has been estimated that a 10 per cent increase in price will be followed by a 2 per cent increase in acreage. Similarly, a 10 per cent reduction in price will produce a 2 per cent reduction in acreage. On the other hand, it takes less than a 2 per cent increase in demand to raise prices 10 per cent if supplies were to remain constant. In economic terms, if the price elasticity of supply with respect to price is less than the price elasticity of demand, and if these are the only factors operating, the mathematically certain result would be the eventual stabilization of production at a level which can be sold at a price that will just cover cost of production for the least efficient producer willing to stay in business. Also, prices will be extremely stable and variations will only come about through differences in total crop yields resulting from weather variations.

However, this equilibrium between supply and demand has not been reached, either on a regional or a total market basis. The conclusion is that other factors are operative in the planting decisions of growers and in the acreage planted in any region in any year. It now appears probable that growers are forced to take into account their position following good or bad returns from more than one year ago. They also must consider their appraisal of potential markets

for the coming year including their guess as to the decision of other producers in their own or other regions.

Improved equilibrium between supply and demand might be obtained if supply could be made less responsive to price changes or if demand could be made more responsive to price charges. As potato production becomes more specialized in the hands of producers with large fixed investments, there is less inclination or flexibility for producers to change their acreage from year to year. This means elimination from the industry of most of the small "in and outers". In view of the inter-regional exchange and movement of potatoes, this trend can have little effect until it has extended to all areas producing a significant quantity of potatoes. I can offer no suggestion as to a means whereby this process can be hastened. Alternatively, if demand could become more responsive to price, a similar stable result could be approached. This would mean that consumers would have to be ready to use substantially more cheap potatoes than high-priced ones. This appears to be unlikely for fresh trade. When the housewife shops for potatoes and finds them to be cheap, she does not pick up an extra bag, but rather spends the money saved on something else. Similarly, when Mrs. Housewife finds prices high she does not face her husband and family without potatoes, instead she has some words of advice to the merchant and cuts down her purchase of other products. This is an over-simplification but, I believe, is a reasonably fair picture of what actually takes place at the check-out counters across the country.

However, it may be possible for potato processing or industrial use of potatoes to become more responsive to price variations. This will be more feasible in plants where potatoes may be used in substitution for other products. Again the stabilizing effect of such eventual developments would not be greatly felt until they become common in all significant producing regions.

In the meantime, it appears inevitable that variable prices and fluctuating supplies will continue to dominate the potato markets of North America. It has sometimes been suggested that price supports could stabilize the market. Without going into details, it appears that price support as a device for stimulating consumption in low price years would not be an effective remedy, even if such a program were coordinated on an international basis. The main effect would be to reduce the uncertainty in the market, raise the average price, call forth increased production which was not wanted, and provide an incentive to use resources for excess potato production at the expense of other commodities for which there was a legitimate market.

One method which could help would be long range and extremely accurate price forecasting as a guide to plantings. In view of the effects of weather on crop yeilds, this must await greater precision in long-range weather forecasting. I am assuming that North American growers are not ready to demand government controls of production in the hope of guaranteeing accurate price predictions. To be truly effective, this would require a controlled and deliberate production of surpluses to be sure of always having enough potatoes and then systematically destroying the excess production. One could go on to mention other methods which might be effective for stabilizing the markets for potatoes alone, but which in total results would be demonstratively wrong.

If we are to be confronted by fluctuating markets, depending in any year on the total crop and also on the regional distribution of that crop, there appears to be a number of considerations which may serve to increase average returns to those engaged in the growing and marketing of potatoes. The most fundamental one is the exercise of restraint in expanding production when markets look favorable. Over-expansion, if coupled with good yields, can result in a large total crop which is actually worth fewer total dollars than a somewhat smaller crop. If this principle can be widely understood by growers, especially those growers who have the capacity for large percentage changes in their plantings, there may be some prospect of a useful increase in total returns to all concerned. There is also the advantage that customers may become adapted to paying reasonable prices for potatoes, if they are not frequently confronted with years when prices are unreasonably low. Promotion of the value of potatoes and assurance of consistent high quality, can help retain them as a staple food item. The diversification of potato products and packages may offer consumers a range of choices, any of which helps to increase consumption.

In this article I have attempted to emphasize the interdependence of potato-producing areas in North America for ensuring a continuous supply of potatoes and the effect on the total market of any unusual surplus or deficit in any significant region. There are few other industries in which the potential economic rewards are so great for close mutual support and co-operation.

Because of the facts of geography and climate, it is unlikely that the present regionalized nature of production and marketing can change very much or very quickly. In the meantime the more that can be learned about all aspects of potato production and marketing, and the more that such knowledge can be widely distributed throughout the industry, the better for all concerned.

A. B. STEVENSON AND B. B. VIRGO

In recent years grape growers in the Niagara Peninsula of Ontario have become concerned by the apparent increase in the amount of bird damage to ripening grapes. In response to requests for action, the CDA's Research Station at Vineland Station and the Canadian Wildlife Service are attempting to determine causes of the damage and to uncover new or improved methods of reducing it.

Our observations in sample vineyards from 1963 to 1965 suggest that the over-all loss of grapes in the Peninsula is not more than 1% of the gross value of the crop. However, losses by individuals vary and depend primarily upon the variety grown and the type of habitat surrounding the vineyard, although other factors may contribute.

In our investigations at the CDA Research Station, we have found that the date of maturity, the size and color of berries, and the amount of foliage, influence the amount of damage any variety suffers from birds. Thus, the late-maturing varieties of the labrusca type, with their large berries covered by much foliage (e.g. Concord, Niagara), are damaged lightly and infrequently. The average loss for these types, which have been extensively planted for many years, is 0.2%. Some of the newer varieties, particularly those with dominant vinifera (European-type grape) characteristics, suffer relatively heavy damage from birds. The French hybrids, including several early-maturing varieties with small dark berries that are exposed because of paucity of foliage, suffer losses ranging from 2 to 10% in mature vineyards. In 1965, the French hybrids made up only 6% of the total crop but they suffered 56% of the bird damage losses. However, as some of these hybrid varieties command a price 50% higher than the standard varieties they are still economically advantageous to grow.

Our research revealed that bird damage is usually more severe in vineyards located near woods and hedgerows as these provide roosting sites for the birds between feeding forays. This effect appears to be quite localized and woods located more than 50 yards from the vineyard probably have no influence on damage. The fact that more species of birds may be present in a wooded area may also tend to increase the amount of damage.

In our studies, we observed that damage by birds, which may begin a month before harvest, is of two types. Varieties with small berries, such as Foch, have the fruit completely removed from the stems and though the bunch is thereby reduced in weight, it may

Dr. Stevenson is an entomologist with the CDA Research Station, Vineland Station, Ont., and Mr. Virgo is research ornithologist, Canadian Wildlife Service, Aurora, Ont.

BIRD DAMAGE
n niagara peninsula
vineyards

still be marketed. Varieties with larger berries, such as Seneca and New York Muscat, have holes pecked in the fruit. This may result in secondary infestation by fruit flies and rot thereby ruining the entire bunch.

Twelve species of birds are known to damage grapes in the Niagara area. Of these, only the robin (*Turdus migratorius*) and the starling (*Sturnus vulgaris*) are important. These two species present two very different problems largely because of the marked differences in their behaviour. Our studies suggest that the robin is the more important of the two.

At the time of grape harvest, we observed that starlings assembled in flocks, varying from a few individuals to several thousands, and travelled over relatively large areas alternately roosting, feeding, and flying. A flock alighting in a vineyard can do extensive damage in a short time. However, starlings are extremely wary and can be effectively repelled from vineyards by the use of acetylene exploders and shotguns. Because of the highly developed communication between individuals, the entire flock will flee even if only one member is disturbed. Thus, the high potential of the starling to cause damage is rarely attained.

The robin's scientific name means "wandering thrush". However, our observations suggest that the robins feeding in a vineyard will return, day after day, as long as grapes are available, before moving to another feeding area. They enter the vineyards in the early morning, by one's and two's, and remain there all day. Although robins do not form true flocks, they tend to congregate in small groups within the vineyard. It is not possible to frighten robins from a vineyard. We have observed robins feeding within 10 feet of an exploder and completely ignoring it; similarly, shooting several members of a group results in the survivors flying 50 ft. or so and settling down again. Other devices such as scarecrows, tin foil plates or streamers hung from the vines also have no effect.

Since at present there is no effective way of reducing robin damage, the Canadian Wildlife Service (the Federal agency responsible for all migratory birds in Canada) has initiated a study of the robin. The object is to discover their source and destination, their birth and death rates and the factors influencing these rates, their natural diet and their patterns of local movement. With this information we hope to be able to reduce the amount of grape damage caused by robins.

1—Bird damage to the variety New York Muscat

2—Bird damage to the French hybrid variety Foch

3—Banding a robin for recapture study

ECHO

NOTES AND COMMENTS FROM THE FIELD

NEW SECTION FOR LONDON RESEARCH INSTITUTE—A research team on soil insecticides is being formed at the CDA Entomology Laboratory, Chatham, Ont. The team is headed by Dr. C. R. Harris, and will move to London Ont., to become a section of the London Research Institute when suitable accommodation has been obtained, probably next summer. The Institute already is responsible for the team's program.

The section will study the efficiency, behaviour and fate of insecticides applied to soil. It is now conducting a survey of insecticide residues in soil in Southwestern Ontario, and studying the influence of soil type and climactic conditions on the effectiveness and persistence of soil insecticides.

The section has the special responsibility of developing a microplot technique to determine the effectiveness of soil insecticides. It is believed that by using this technique the team can greatly reduce the present regional trials of soil insecticides and speed up the program.

Dr. Chin-Ming Tu, soil microbiologist and Mr. J. R. W. Miles, pesticide chemist are also on the team. In addition, there is a full technical staff. A soil physical chemist, an insect ecologist and an applied entomologist will complete the staff.

NEW ROSE PROJECT—Two outstanding new roses have emerged so far from a long-term project at the CDA Research Station, Ottawa, Ont., to develop Canadian everblooming and winterhardy roses. They are Rugosa F06 and the Rugosa-Chinensis hybrid H16.

After another year of testing, it is hoped to announce the formal release of this seedling for commercial reproduction. It is a shrub five to six feet tall, with no thorns on the upper branches. The fragrant double blooms grow in small clusters from the end of June until frost, and are two tones of pink with a darker hue at the base of the petal. After being grown and tested in the United States and Canada, this rose has proved itself everblooming, disease resistant, and winter-hardy.

Having had only two years of testing, the Rugosa-Chinensis hybrid H16 must still undergo several trials. However, it has survived a very cold winter with little snow protection, and is also everblossoming and disease resistant. Flowers are double, pink and fragrant, and in the tradition of the Chinensis rose to which all cultivated roses trace their ancestry. H16 is a distinct improvement on both of its parents and could have a future in the industry.—(MISS) F. J. SVEJDA, OTTAWA, ONT.

SELF-PROPELLED FORAGE HARVESTER—A small plot sickle forage harvester has been developed at the Swift Current and Saskatoon CDA Research Stations capable of harvesting legumes up to 30 inches tall. Power is supplied hydraulically for propelling and driving the knife, reel, elevator canvas and auger conveyor. A hydraulic cylinder controls the cutting bar height.

Turning radius of the machine is 11 feet; cutting width 36 inches. Cutting bar height can be varied from 0 to 12 inches, and operating speed is 0 to $1\frac{1}{2}$ m.p.h. In operation, the machine raises the cut material, takes it to the rear of the machine and places it on a suspended canvas. The harvester worked well on all forage crops except mature sweet clover.

In field tests, a 4-man crew was used: the operator, two other men carrying samples and a third in the weigh shed.

On a crested wheatgrass test, 72 plots an hour were cut and weighed, averaging 50 seconds a plot. A similar crew cut a plot of alfalfa every 45 seconds. The machine was also used as a header to harvest grass seed from spaced and increase plots.

Materials and commercial parts cost $3,000.00. Plans are available from the CDA Experimental Farm, Swift Current, Sask.—J. L. THOMPSON AND H. C. CASWELL, SWIFT CURRENT, SASK., AND R. K. DOWNEY, SASKATOON, SASK.

NEW METHOD KEEPS TOMATOES GREEN—Pickling tomatoes will stay green in low oxygen storage for three to four weeks, according to recent tests at the CDA Research Station, Kentville, N.S. Previously, processing within a few days of harvest was necessary to prevent severe losses from ripening or rotting. Bruising and cracking takes a further toll, especially if the fruit is handled in bushel-size crates or hampers. Such cracking leads to loss of juice, which raises the humidity, and allows microorganisms to enter, causing serious rotting.

To store green tomatoes, simply place them, in boxes, in a precooling room at 40°F. When their temperature drops to 50°F, seal them in gas-tight chambers in a room held at 60°F.

The chambers consist of wooden frames covered with double wall aluminum foil or a gasproof plastic film. They contain bags of hydrated lime to remove carbon dioxide produced by the tomatoes and a portable household type dehumidifier equipped with a humidistat to remove excess moisture. When the storage chamber is filled, flush it with nitrogen gas to remove the oxygen and then seal it.

During storage, keep the relative humidity at 70 to 75 per cent, and the oxygen level from 0 to 5 per cent. When the chambers are properly sealed, the oxygen level remains fairly constant and the tomatoes stay green for 3 to 4 weeks—C. L. LOCKHART AND C. A. EAVES, KENTVILLE, N.S.

ACCROISSEMENT DE LA PONTE CHEZ LES OIES—Le croisement des races apportera peut-être une solution au problème de la faible production d'oeufs, facteur qui limite l'expansion de l'élevage des oies. L'oie pond en moyenne 20 à 40 oeufs par année, en comparaison de la poule qui en produit 150.

Le croisement des races est une technique acceptée dans l'élevage des poulets et des dindons mais peu pratiquée dans l'élevage des oies.

A l'Institut de recherches zootechniques du ministère de l'Agriculture du Canada, nous avons étudié les avantages du croisement des oies. La deuxième année des recherches vient de se terminer et les premiers résultats nous permettent de constater que cette technique serait en effet avantageuse: la ponte moyenne chez les oies croisées a été de près de 27 p. cent plus élevée que chez les sujets de race pure.

Nous avons utilisé trois races: la Pilgrim, la Hongroise (qui ressemble à l'Embdem) et la Chinoise. L'oie chinoise a été la meilleure pondeuse, mais son rendement a été inférieur à celui de certaines oies croisées. La progéniture de ces sujets croisés est présentement soumise aux épreuves de croissance.

Le croisement des oies présente une difficulté: celle d'obtenir des sujets croisés à plumage blanc. Les établissements de transformation préfèrent des oies blanches parce que les plumes se vendent un peu plus cher et aussi parce que les chicots sont moins perceptibles sur la carcasse.

Les chercheurs de l'Institut s'intéressent aussi à la transmission de la couleur chez les oies. Les premiers résultats permettent de supposer que la couleur est liée à plusieurs gènes, et cette étude devrait donner certains indices sur le meilleur moyen d'accoupler les races pures et les races croisées pour obtenir une volaille de marché à plumage parfaitement blanc.—M. E. S. MERRITT, OTTAWA.

To mark the end of the first phase of the federal program to eradicate brucellosis, Agricultural Minister J. J. Greene draws a blood sample from the neck of a Holstein cow at Hercule Nicole's farm, Montmagny Quebec. Lending a hand is Dr. K. F. Wells, (left) CDA Veterinary Director General. Upper right: Dr. Olier Senneville, federal veterinarian located at Montmagny. The blood sample was subsequently sent to a CDA laboratory for testing.

Afin de souligner la fin du premier stade du programme canadien d'éradication de la brucellose, l'Hon. J. J. Greene effectue lui-même la prise de sang sur la dernière vache à subir l'épreuve. L'événement eut lieu sur la ferme de M. Hercule Nicole à Montmagny, P. Qué. On aperçoit à gauche le Dr. K. F. Wells, Directeur vétérinaire général du ministère le l'Agriculture du Canada. En haut à droite, le Dr. Olier Senneville, vétérinaire fédéral de Montmagny. L'échantillon de sang fut ensuite dirigé vers un laboratoire du Ministère pour l'examen.

MORE WOOL NEEDED, FEWER SHEEP BRED—Each year the Canadian manufacturing industry needs more wool, yet each year the Canadian farmer breeds fewer sheep.

Canada imported 65,000,000 pounds of wool in 1965, says the Markets Information Section of the Canada Department of Agriculture in its wool grading report for that year. Imports have varied from 100,000,000 in 1946 to 40,000,000 in 1954.

Canadian wool gradings in 1965 totalled 4,412,636 pounds compared with 5,065,363 in 1964 and 15,478,000 in 1946. To eliminate wool imports, say CDA Livestock Division Officials, Canada would need 9,000,000 rather than her present 1,000,000 sheep.

Total wool gradings (pounds) by provinces: B.C.: 215,782; Alta.: 1,439,201; Sask.: 529,995; Man.: 165,591; Ont.: 1,124,904; Que.: 500,345; N.B.: 120,476; N.S.: 154,869; P.E.I.: 56,572; Nfld: 104,267.

SELF-FERTILE CHERRY RELEASED—The self-fertile cherry "2C-27-19" is being released by the CDA Research Station at Summerland, B.C., for limited grower trial. This selection is from a cross made in 1956 between "Lambert" and pollen of "John Innes 3 45." The latter is a self-fertile selection produced by Dr. D. Lewis at the John Innes Horticultural Institute, England, by X-irradiation during the early stages of pollen development.

The Summerland cherry "2C-27-19" has consistently set good crops of cherries upon selfing under controlled conditions with no outside pollination. Fruits are large with good, dark red color and sufficient firmness. K. O. LAPINS AND (MISS) CATHERINE H. BAILEY, SUMMERLAND, B.C.

MORE GOOSE EGGS? Cross-breeding of geese might solve the problem of their low egg production. At the end of the second year of a cross-breeding study being carried out at the CDA Animal Research Institute at Ottawa, Ont., average egg output was 27 per cent higher in the crosses than in the purebreds.

Poor egg production has been an important factor limiting expansion of the goose industry. An average female lays between 20 and 40 eggs a year, whereas the annual output of a meat-type chicken is 150 eggs. Cross-breeding of chickens and turkeys is an accepted practice, but has not been followed to any extent with geese. So the study was undertaken to see whether there were any advantages to using such a program for geese.

Three breeds of geese were used: Pilgrim, Hungarian (similar to Embden) and Chinese. The latter were the heaviest layers of the purebred lines, but were outdone by some of the crossbreds.

A problem in crossing geese is the difficulty of producing a white-feathered crossbred bird. (The processor prefers white birds because the feathers increase the sale price and its pins are not so noticeable on the carcass.)

Researchers at the institute are investigating the inheritance of color in genes. Preliminary results also indicate that color is controlled by many genes, but the study should give some indication of the best way to mate purebreds and crossbreds to produce as white a market bird as possible.—E. S. MERRITT, OTTAWA, ONT.

OVERHEAD IRRIGATION SLOWS TOMATO MATURITY Field tests on tomatoes carried out in 1966 at the CDA Research Station, Summerland, B.C., showed that overhead irrigation delayed their maturity. Replicated field experiments included sprinkling, misting, and furrow application of water.

Early yields (to Sept 7) averaged 11.07 and 11.08 tons per acre for mist and sprinkler plots. Where furrows were used, yield was 13.23 tons per acre.—L. G. DENBY, SUMMERLAND, B.C.

drought hazard in the ottawa valley

W. BAIER

Severe droughts have occurred in the Ottawa Valley in recent years and farmers and gardeners have become increasingly interested in the chances for drought and the feasibility of irrigation. Much basic information on soil characteristics, water needs of crops, climate and marketing conditions is required for making decisions on the economy and design of an irrigation system. A statistical analysis of climatic data provides the background for irrigation requirement studies on the amount of water needed, time and frequency of applications.

Recent droughts, particularly that of 1965, are well remembered. Therefore, a sound knowledge of average conditions and possible extremes will be useful in planning water requirements and irrigation schemes. In our studies at Ottawa last year, we compared the 1966 and 1965 total rainfall and distribution during the five weeks from May 17 to June 19. The long-term averages (see Table 1) illustrate the wide fluctuations in weather that must be expected in Eastern Ontario from year to year. The total rainfall for this period in 1966 was 3.92 inches, 23 per cent higher than normal. In 1965, only 0.46 inches or 14 per cent of the normal was recorded. In fact this was the lowest total for the same five-week period since weather observations were begun at the Central Experimental Farm in Ottawa in 1890.

Even more striking is a review of the soil moisture available to plants as computed for the Ottawa area. Since the beginning of the 1966 growing season, the plant available moisture decreased steadily to 2.15 inches on June 12 and then increased to 2.32 inches during the week ending June 19. In 1965, the moisture storage at the end of May was already as low as 1.14 inches and dropped further to 0.26 inches on June 19. In both years, moisture conditions deteriorated rapidly during the week ending June 26. In the drought year of 1965 no water was any longer available to plants, but in 1966 there was still 1.42 inches available.

These figures show that in a particular soil and for the same time of season, plants had almost no water available in one year but approximately half of the total storage capacity in the following year. While in 1965 irrigation was necessary in May to save crops from drought damage, moisture conditions were adequate for most plants until the end of June in 1966.

Climatic means or totals are inadequate characteristics to depict the effect of such weather fluctuations on irrigation requirements. Statistical techniques have been developed at the Agrometeorology Section to evaluate frequencies of moisture deficiencies in terms of probabilities or drought risk from standard climatic data. These take into account various water holding capacities of different soils and consumptive use factors which have to be selected according to crops. To account for short-term fluctuations in rainfall and evaporation, the analysis is based on daily weather observations, whereas the supplemental irrigation requirements are calculated on a weekly basis. Because of the wide fluctuations in weather from year to year as illustrated above, such calculations should be based

---

Dr. Baier is a specialist in ecoclimatology, Agrometeorology Section, Plant Research Institute, CDA Research Branch, Ottawa, Ont.

on long-term climatic observations, say, over 30 years. Therefore, data handling is considerable and the fairly complex calculations have to be done by modern computer techniques. A package of computer programs for calculating supplemental irrigation requirements from standard climatic data is available for irrigation studies. The results in terms of frequencies or probabilities of water needs are readily interpreted and have many practical applications. The accompanying graph gives the water requirements for various risks. The risk can be interpreted as the number of years in 100 which, at most, require a given amount of supplemental water.

From the tables obtained as computer output, it is possible to determine for any period of the season the amount of irrigation water required for soils with a given water holding capacity, and for crops with a given consumptive use factor. For example, in a field where the crop fully covers the soil and the soil holds three-inches of plant available water, the water need is for at least 2.3 inches of irrigation in one year out of two. Under like conditions, the need is 8.8 inches in one year in four and 15.1 inches in one year in ten.

It is also possible to determine the dates when the first irrigation of the season has to be applied. For example, a soil holding 3 inches of plant available water would require, in nine out of ten years, the first irrigation on June 7, if 50 per cent of the available water may be safely removed from the soil before crops suffer from the lack of moisture. Under the same conditions in a soil of 5 inches capacity, the first irrigation is necessary almost one month later, namely on July 5. Obviously, the dates of the first irrigation application and the seasonal requirement totals decrease with increasing storage capacities and with decreasing consumptive use factors. From Table below it is possible to determine for any probability level the seasonal supplemental water requirements in soils of various storage capacities for plant available water. Accepting a risk of one in ten (10 per cent risk in Table) the farmer whose sandy soils hold a maximum of only 1 inch of water for a shallow rooted crop has to apply 19 inches in the course of the season to supply the plants adequately with water. Only 11 inches would be required for a deep rooted crop growing in a soil with a water holding capacity of 5 inches.

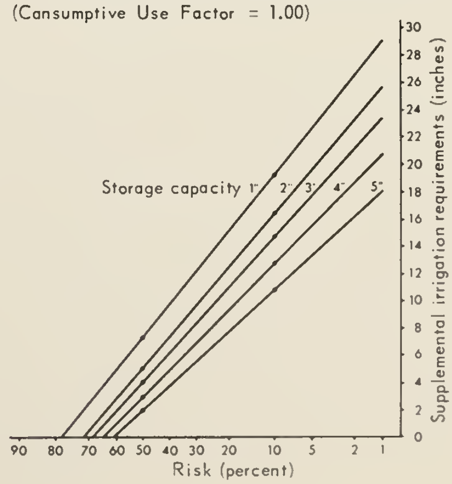
Since both expense for irrigation equipment and labor involved in irrigation management increase rapidly with the area under irrigation and frequencies of applications, the farmer assisted by an irrigation specialist has to balance carefully the risk that is acceptable under the specific farming conditions against the costs involved. The supplemental water requirements given in this article are based on daily potential evaportranspiration rates estimated from climatological data. Water losses during irrigation are not accounted for. Therefore, the data refer to optimum water use, and adjustments for local soils, topography and farming practices are necessary to effect the desired application. Yet, a proper analysis of the supplemental irrigation requirements based on available climatic data can be most useful for planning irrigation systems and eventually for the economic success of irrigation schemes.

The meteorological data used in this article for illustrating fluctuations in weather conditions were taken from the Weekly Weather Report of the Agrometeorology Section, Plant Research Institute, Central Experimental Farm, Ottawa.

TABLE 1—WEEKLY RAINFALL AND PLANT AVAILABLE SOIL MOISTURE AT OTTAWA WEATHER SITE: MAY TO JUNE, 1965 AND 1966. (STORAGE CAPACITY=4.00 IN.)

	Rainfall			Plant available soil moisture	
Period	Longterm average	1965	1966	1965	1966
	in.	in.	in.	in.	in.
May 17-23	0.75	0.11	1.26	1.66	3.11
May 24-30	0.64	0.17	0.67	1.14	2.69
May 31-June 6	0.55	0.04	0.71	0.72	2.63
June 6-12	0.53	0.08	0.39	0.55	2.15
June 13-19	0.71	0.06	0.89	0.26	2.32
June 20-26	0.89	0.33	0.02	0.00	1.42
May 17-June 19	3.18	0.46	3.92	—	—
May 17-June 26	4.07	0.79	3.94	—	—

Probability for seasonal supplemental irrigation requirements at Ottawa (1931-1960) for soils of various storage capacities for available water (Consumptive Use Factor = 1.00)



D. R. MACGREGOR AND J. F. BOWEN

Those of us who are fortunate enough to enjoy the benefits of modern rural living are all aware (particularly when the septic tank goes wonky) that waste disposal can present real problems. The food processor is faced with the same problem on a much larger scale. A fairly small fruit or vegetable cannery will produce as much organic waste as a city of 6000 people, a large operation may be faced with half a million gallons of unwanted, contaminated water a day. Obviously, a septic tank and tile field is out of the question, so what to do?

We depend on nature's various cycles to purify waste water for re-use, along with a little assist from man's ingenuity. This ingenuity gets a particularly good workout when it comes to food processing plant wastes. In our investigations at the CDA Research Station, Summerland, B.C., we have been studying ways of helping nature in her task as the universal garbage disposal unit.

The requirements for waste oxidation are oxygen, nutrients, microbes and time in the correct proportions and conditions. These vary depending on the characteristics of the waste under consideration, and their determination forms the basis of our waste disposal studies at Summerland. Since it is not economically feasible to do research on a plant scale of perhaps 500,000 gallons per day, we have designed pilot plant units handling 2 gallons per day in which the factors mentioned above can be controlled and varied as needed. So far we have worked only with nutrients (nitrogen levels) and time, and have found it possible to remove up to 99% of the soluble organic matter or B.O.D. (which is described later). We plan to continue these studies, and, in cooperation with a local processor, are designing and preparing to operate a 1000-gallon-per-day unit which will be located at the cannery. We hope that this unit will be large enough to provide some answers to the dollars-and-cents questions involved.

Since waste disposal and water pollution are becoming increasingly pertinent topics, perhaps a discussion of what is involved in liquid waste disposal and how it is presently handled, is in order.

THE BIOLOGICAL BASIS OF WASTE DISPOSAL

Every constituent of our bodies has been re-used to some degree. For example, take fresh air; how many other people have breathed the air you are breathing now? No one knows but it has been calculated that it is a 50/50 chance that at least one molecule of the air you take in with your next breath was also breathed by Julius Caesar (or Cleopatra if you prefer). Similarly, the water you drink has passed through uncountable bodies before it reaches you. The water cycle is quite simple and familiar to everyone. Another example is the carbon cycle. This cycle is more complicated and of more direct concern to the problem of waste disposal. Carbon dioxide is present in the atmosphere and is taken up by plants and made into sugar and other products. The farmer then harvests the plant, a peach or an ear of corn, and delivers it to the processor for canning. During the process, part of the waste is removed from the plant by water, part is trucked away, and we eat the rest. Most food ultimately ends up in the sewer so we now find most of the peach or corn in water. Under normal circumstances, bacteria in the water combine this waste with dissolved oxygen to produce carbon dioxide which may be returned to the atmosphere to go through the cycle again.

Similar cycles operate for nitrogen, phosphorus, sulfur and other essential body constituents. For these cycles to operate properly in the water step, dissolved oxygen must be present in the water and this is the heart of the whole problem. When food for the bac-

---

Dr. MacGregor is head of the Fruit and Vegetable Processing Section and Dr. Bowen is a microbiologist with the Section, CDA Research Station, Summerland, B.C.

The CDA Research Station, Summerland, B.C., recently started pilot plant projects in the laboratory and field on fruit cannery wastes. Much research needs to be done on food plant wastes and it is hoped that an economical, practical method of aerating and screening will be found.

waste disposal in food

teria is present in excess and all the oxygen is used up undesirable things happen. Fish and other aquatic animals cannot live in the water, the type of bacteria changes from aerobic to anaerobic, foul odors are produced, the cycle breaks down and we realize too late that something is wrong.

The basis of all waste disposal systems is the provision of sufficient oxygen so that oxidation or removal of organic material can be carried out normally. In most systems this is done by some means of aeration. However, as usual, when man interferes with natural cycles complications arise. We attempt, in a treatment plant, to do in a day a job that nature might require weeks, and a large area to accomplish. In a treatment plant the object is to build up a large bacterial population so that the waste is oxidized rapidly. This requires that the microbes are fed a properly balanced diet, which means the presence of usable forms of carbon, nitrogen and phosphorus and the absence of toxic materials. We seldom think of a sewage works as a garden but this is actually the case.

Bacteria break down wastes to simpler compounds and these compounds are utilizable by green plants. Because of this, when we discharge properly treated waste into a body of water a condition known as enrichment or eutrophication occurs. This means that the fertilizer value of the water has increased and it will support a greater density of aquatic plants such as algae and weeds. In a biologically poor or infertile water supply, this may be desirable since the fish population will also increase, but over-enrichment leads to excessive plant growth giving murky water and the choking of waterways with weeds.

All of the bacteria found in waste water may not be harmless. An efficient waste treatment plant will kill off disease producing bacteria. Recently we have become aware of waterborne virus diseases. There is a possibility that some viruses may pass through a treatment plant without being destroyed. Fortunately, wastes from fruit and vegetable processing operations present almost no public health hazard.

B.O.D. AND C.O.D.

In our investigations at the Summerland Research Station, we are doing B.O.D. and C.O.D. analyses, familiar terms wherever waste treatment is discussed. They stand for Biochemical Oxygen Demand and Chemical Oxygen Demand respectively and an understanding of what they mean is essential to any intelligent discussion of waste treatment. First, B.O.D.: It was mentioned previously that oxygen is necessary to break down or mineralize waste. The pollutional strength of a waste can be measured by the amount of oxygen the micro-organisms will require to render it innocuous. The more oxygen required the stronger the waste. We can measure B.O.D. in any units we choose. The most usual are parts per million (ppm) and pounds. A B.O.D. of 1,000 ppm means that 1,000 pounds, ounces, grams, etc. of oxygen would be required to treat 1,000,000 pounds, ounces, grams, etc. of waste. A B.O.D. of 1,000 pounds means that 1,000 pounds of oxygen are required to treat the volume of waste under consideration, whatever it is. The Biochemical in B.O.D. indicates that the strength of the waste has been determined in the laboratory by incubating the waste in the presence of suitable bacteria for varying periods of time, usually either 5 or 20 days. The amount of oxygen used by the bacteria during incubation is measured and the B.O.D. determined from this.

We express C.O.D. in the same units as B.O.D. The difference is in the method of determining the amount of oxygen needed for stabilization of the waste. In the C.O.D. the work of the bacteria is done by a digesting solution of sulphuric and phosphoric acids together with potassium permanganate.

In our studies at Summerland, we do both B.O.D. and C.O.D. analyses and have found that each has its advantages. The B.O.D. more accurately reflects the treatment necessary for the waste but it is very laborious to determine. The C.O.D. is easy to determine but by itself means little. By running preliminary tests and correlating B.O.D. with C.O.D. for a given type of waste, we can use the C.O.D. for routine sampling with occasional B.O.D. checks. Many food processing plants run C.O.D.'s in their own labortories and this is very useful for plant trials on water re-use and studies on reducing the amount of waste entering the water supply. An important point to realize is that water can hold 9-11 ppm of dissolved oxygen, therefore a typical cannery waste with a B.O.D. of 1000 ppm must either be diluted over 100 times or else have a great deal of oxygen added to it to achieve even minimal treatment.

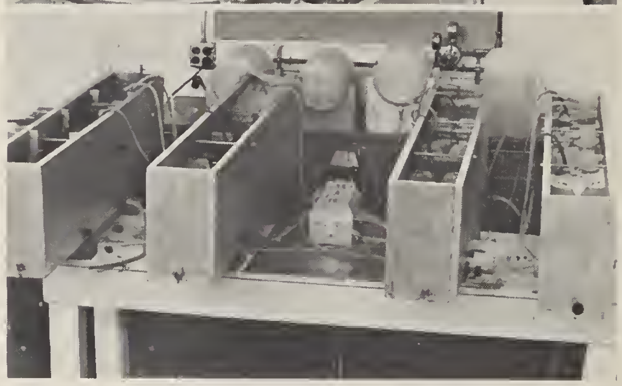
TYPES OF WATER-BORNE WASTE

In our investigations at Summerland, we divide water-borne waste, for treatment purposes, into three categories, although our emphasis is concentrated on the 'Food Plant' category which is discussed under item 2 which follows.

1. Domestic.—This is the waste produced by the *normal* household. It consists of chiefly wastes from food preparation and disposal, laundering and human excreta. Surprisingly, it is quite dilute and *normally* has a B.O.D. in the neighbourhood of 200 ppm. Because of its varied composition, it is *normally* quite well balanced and contains adequate nitrogen for bacterial growth. The main problems connected with domestic waste treatment are: overloading of old

processing

Dr. J. F. Bowen and Dr. D. R. MacGregor examining sludge characteristics in pilot plant equipment



Laboratory equipment for studying removal of B.O.D. from cannery wastes. Fruit and vegetable processing laboratory, Research Station, Summerland, B.C.

plants, possible public-health hazards and the presence of detergents which do not break down. A move is now afoot in many countries to require the manufacture of "soft" detergents which will break down in treatment plants and eliminate the problem of foaming in water supplies in more crowded areas.

2. Food Plant.—Food plant wastes differ from domestic wastes in important respects depending on the type of product handled. Fruit and vegetable plant effluents may have a high B.O.D. which varies with the raw material and the amount of water re-use. Examples of the B.O.D. resulting from different canning operations are: applesauce 1685-3450, asparagus 100, carrots 520-3030, peaches 1350, pears 2250-4700 and tomatoes 570-4000. A peach cannery packing 1000 cases per day produces waste having a B.O.D. equivalent to a community of 6000 persons. Normally, this strong waste is very poorly balanced and is deficient in almost all bacterial nutrients except carbon. Because of this we may have to add nitrates before it can be treated and even then great care must be exercised to avoid trouble when a small municipal treatment plant is being used.

3. Industrial wastes.—The composition of these varies tremendously from some which have a very high B.O.D. to others which may have no B.O.D. but contain toxic chemicals. These wastes must be completely excluded from watercourses until they are treated by various means.

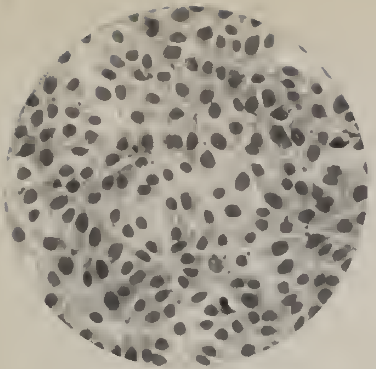
ENGINEERING OF WASTE DISPOSAL SYSTEMS

Unless waste can be disposed of by discharging into large bodies of water such as rivers or the ocean or by sprinkling on land, a disposal unit must be designed.

Naturally, engineers design waste disposal systems to reduce the B.O.D. of a given waste to a predetermined acceptable level at the lowest possible cost. This level to which the B.O.D. must be reduced varies with local authorities but normally it is between 15 and 30 parts per million. Each province has a Pollution Control Board, some of which exercise very little control. In some areas new food plants must have their waste disposal design approved by the board and increasing pressure for improvement is being brought to bear on established industries. A cost of 4½¢ per case of canned goods for sewage treatment has been forecast in a very few years.

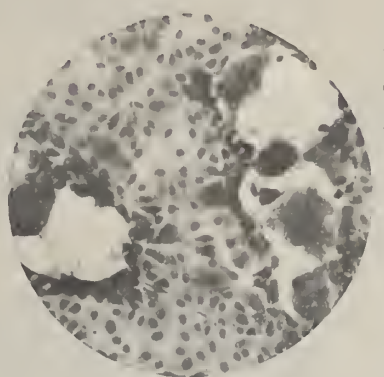
In order to design a treatment plant the engineer must have a great deal of information on the physical, chemical and biological characteristics of the waste under consideration. This information has been pretty well worked out for domestic sewage but a great deal of research needs to be done on food plant wastes. Concerning the latter, the CDA Research Station at Summerland has recently started pilot plant projects in the laboratory and field on fruit cannery wastes. It is hoped that an economical, practical method of aerating and screening will be found.

Similar efforts are under way in laboratories in the United States and Europe. Normally, food processing wastes are compatible with domestic waste. Generally speaking, it is easier to treat wastes from processing plants together with domestic sewage than to treat the wastes separately. Domestic sewage keeps the treatment process in operation over weekends and furnishes at least part of the required nutrients. There are situations where joint treatment is not indicated but it should always be investigated first. Pre-treatment of plant wastes may be desirable to avoid overloading municipal plants. Joint treatment implies some added cost to the municipality and some method of equitably sharing this cost must be worked out. Disposal of food plant and other wastes often gives rise to a conflict of interests between the waste producer and those affected by the waste after disposal. What is considered adequate treatment by one may not be by the other. Fair dealing, common sense, understanding the problem and joint efforts at solution are necessary now and even more so in years ahead to preserve our countryside and waterways for the use and pleasure of future generations.



Cellules normales de rein d'agneau cultivées en couches monocellulaires—100 X

LA RHINOPNEUMONITE ÉQUINE (Avortement à virus de la jument)



Cellules de rein d'agneau, 36 heures après inoculation avec le virus de la rhinopneumonite équine. Formation de syncytia—100 X

A. GIRARD

La rhinopneumonite équine est répandue depuis déjà plusieurs années dans divers pays d'Europe, en Afrique du Sud, aux États-Unis et probablement ailleurs où elle est peut-être confondue avec l'influenza équine. Au Canada, spécialement depuis cinq ou six ans, des foyers d'infection causés par ce virus surgissent dans plusieurs provinces du pays et occasionnent des pertes sérieuses aux éleveurs de chevaux.

Il semble difficile d'évaluer présentement l'incidence de la rhinopneumonite équine puisqu'elle ne se trouve pas au nombre des maladies nommées (Loi sur les épizooties, Direction de l'Hygiène vétérinaire). En plus cette maladie peut se manifester chez tous chevaux susceptibles, sous des formes cliniques souvent confondues avec d'autres maladies.

En 1961, lors d'une enzootie de rhinopneumonite dans l'est de l'Ontario, un groupe de chercheurs de l'Institut de Recherches sur les Maladies des Animaux, Hull, Qué., a étudié les lésions macroscopiques et microscopiques observées sur l'avorton. Pour la première fois au Canada, l'isolement du virus en cultures de tissus a aussi été rapporté par ce groupe.

Les symptômes de la maladie ne sont pas pathognomoniques chez la jument. Ils se manifestent par un écoulement nasal et une élévation de température qui disparaissent rapidement. Il ne faut pas confondre avec la rhinopneumonite, les rhumes que l'on observe fréquemment à l'automne et au début de l'hiver chez les poulains et les jeunes chevaux. Cependant il faut redouter les infections catarrhales graves qui se propagent rapidement aux juments.

D'après les observations faites dans plusieurs pays, les juments exposées au virus au cours des trois premiers mois de gestation n'avortent pas. Par contre l'avortement est possible après le quatrième mois de gestation, particulièrement entre le 8e et le 10e mois. Ordinairement, les juments atteintes de la maladie poulinent sans difficulté, mais avant terme. Lorsque la mise-bas se produit à terme et que le poulain est vivant, il naît faible et ne vit que quelques jours.

Le diagnostic clinique peut être confirmé au laboratoire par l'examen histologique, l'isolement du virus et par la recherche des anticorps. L'examen histologique permet de mettre en évidence dans les cellules de plusieurs organes (cœur, foie, intestin, pancréas, poumon, rate, rein, vésicule biliaire) des inclusions acidophiles intranucléaires spécifiques. Le virus peut être isolé du foie, du poumon ou d'autres organes par inoculation de cultures monocellulaires telles que: cellules de rein de veau, d'agneau, de porc et autres. Les premiers effets cytopathogènes sont caractérisés par l'apparition de foyers de cellules arrondies et la formation de syncytia. Vers le quatrième jour après inoculation, on peut déceler des inclusions intranucléaires. L'épreuve de la séro-neutralisation du virus faite avec des échantillons de sérum, prélevés respectivement durant la phase aiguë et convalescente, peut indiquer, par une augmentation du taux d'anticorps, si l'animal a été récemment en contact avec l'agent infectieux.

Il n'y a pas de traitement spécifique pour cette maladie. Par conséquent, la propreté et la désinfection ainsi que l'isolement des chevaux malades ou nouvellement introduits dans l'écurie constituent les principaux moyens de prophylaxie applicables dans un troupeau sain.

En plus, dans les écuries où la rhinopneumonite a déjà fait son apparition et où le diagnostic a été confirmé par le laboratoire, la vaccination de tout le troupeau peut être permise au Canada. On utilise un vaccin atténué par une série de passages chez les hamsters. Sous le contrôle des officiers de la Direction de l'Hygiène vétérinaire du Canada, ce vaccin peut être administré, dans certains cas, à condition que le propriétaire du troupeau consente à se conformer aux directives énoncées.

Présentement à l'Institut de Recherches sur les Maladies des Animaux, on tente d'analyser sérologiquement et cliniquement, dans un certain nombre de troupeaux la valeur et les conséquences de l'utilisation d'un tel vaccin pour la prévention de la rhinopneumonite équine.

L'auteur est attaché à la section de virologie, Institut de Recherches sur les Maladies des Animaux, Hull, Québec.

CHEMICAL COMPOSITION
CARCASS

H. DOORNENBAL

At the CDA Research Station, Lacombe, Alta., we have been seeking a way to accurately measure the lean meat content in swine. Such a discovery will aid in determining the value of potential breeding stock, assessing the effects of various nutritional regimes and in evaluating the merits of different management systems.

How valid various indices of carcass leanness are, as reported in the literature, depends on the endpoint to which they are related. In our investigations, we are comparing several indices of carcass leanness with the most reliable endpoint that can be obtained, the gross chemical composition of a carcass or cut.

Here's a rundown of what we are doing: After slaughter, the dressed carcass (head, feet, all internal organs, G.I. tract, kidneys, and kidney fat removed) is chilled for 24 hours and then split. On the right half, length and carcass backfat measurements are taken. This side is then divided into the four major cuts, ham, loin, shoulder and belly (Fig. 2). On each of these cuts specific gravity determinations are made. Specific gravity is also determined on the entire left side. The left half carcass and the four cuts of the right half are then frozen. Each individual cut of the right half is sliced, ground in a large grinder and sampled for chemical analysis, e.g., moisture, fat, protein and ash. The left half is cut into 15—16 (depending on the number of vertebrae) cross sections which are photographed in color for planimeter determinations of the areas of lean, fat and bone (Fig. 3). All cuts of the left half are then combined, sliced, ground and sampled for chemical analysis, thus representing the entire left half carcass.

Table 1 illustrates the average protein and fat composition of the carcasses and the four major cuts of 37 Lacombe market weight hogs, representing 19 barrows and 17 females. We obtained a range of

Dr. Doornenbal is an animal physiologist with the CDA Research Station, Lacombe, Alta.

TABLE 1.—PROTEIN AND FAT COMPOSITION OF THE CARCASS, HAM, LOIN, SHOULDER AND BELLY OF LACOMBE MARKET WEIGHT HOGS

	% Protein		% Fat		% Protein		% Fat	
	Ave.	Range	Ave.	Range	Ave.	Range	Ave.	Range
	Males (19 animals)				Females (17 animals)			
Carcass	13.7	12.2–14.7	38.7	32.6–46.0	14.7	13.9–15.9	34.8	29.0–37.4
Ham	15.7	14.4–16.8	29.4	24.8–35.6	16.4	15.6–17.2	27.3	24.4–31.8
Loin	12.7	10.8–13.9	45.2	39.3–53.7	14.0	12.8–15.7	39.8	32.1–43.0
Shoulder	14.5	13.2–15.6	32.5	26.7–38.6	15.4	14.6–16.2	28.8	24.9–31.9
Belly	11.0	9.0–12.5	52.0	42.0–60.7	11.8	11.0–12.8	49.1	43.0–53.3

IN SWINE EVALUATION

1—Weighing of samples for protein and ash determinations

2—Four major cuts of right half carcass: ham, loin, shoulder, belly

3—Locations of cross sections used to measure areas of lean, fat and bone

values showing that a considerable amount of variability existed in what could be regarded as a relatively uniform herd. Although not shown in Table 1, we also found that carcass weight over the weight range in the study had no effect on the chemical composition.

Some of the results obtained thus far may be summarized as follows:

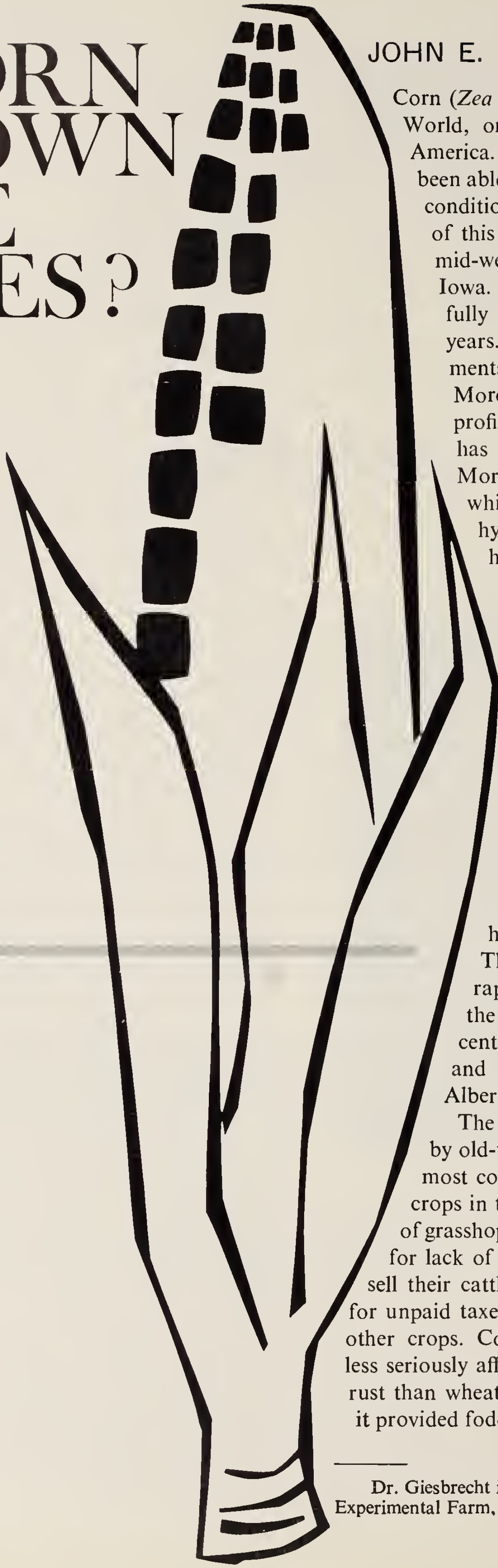
Composition of cuts vs. composition of the carcass: We found that carcass protein could, for most purposes, be predicted with satisfactory precision from the percentages of protein in the loin or in the ham. This finding is of importance in experimental work dealing with the effects of nutrients or biological compounds on body composition. Instead of chemical analysis of the entire carcass, only a loin or ham could be subjected to analysis. We also found that fat and ash could not be predicted from any cut with the same degree of precision.

Percent yield of lean cuts and percent chemically determined protein: Our research revealed that the correlations between these two endpoints were poor for the shoulder and the ham and somewhat better for the loin and the carcass. It would appear that, while percent yields of lean cuts can be considered satisfactory for commercial evaluation of hog carcasses, it is not an accurate index of the actual leanness of a carcass expressed as percent chemically determined protein.

Backfat thickness as an indicator of total chemically determined fat: It has been generally believed that backfat thickness was indicative of the overall fatness of a carcass. Results of our chemical analysis of entire carcasses have shown that the relationship between the amount of backfat or external fat and that of the internal fat (fat between the muscles and within the muscles) is very low or non existant. We have found that pigs of the same sex and with the same amount of total chemically determined fat may differ in total backfat thickness (sum of shoulder, back and loin fat) by more than one inch. Similarly, pigs of the same sex and with the same backfat thickness may differ in total chemically determined fat by as much as fifteen pounds, which represents ten per cent of the average carcass weight. Since the yield of trimmed cuts depends on the thickness of the subcutaneous fat, this low relationship between external and internal fat explains largely why per cent yield of lean cuts is not an accurate index of the actual leanness of a carcass. It means that carcasses of identical weight and backfat thickness, resulting in identical percentages of lean cuts, may well vary greatly in the amount of lean meat.

Relationships between chemical composition of cuts and carcasses with other endpoints, such as specific gravity and areas of lean in several cross sections are under investigation.

CAN CORN BE GROWN ON THE PRAIRIES?



JOHN E. GIESBRECHT

Corn (*Zea mays* L.), a crop native to the New World, originated in the tropics of Central America. This crop has, with the act of man, been able to adapt to a wide range of climatic conditions, and is now grown in most parts of this continent; most successfully in the mid-western area of the U.S.A. centered in Iowa. Corn has also been grown successfully on the western prairies for many years. Research into its cultural requirements at the CDA Experimental Farm Morden, Man., has helped to make it a profitable crop for this area. This station has also developed the corn hybrids Morden 88, Morden 67 and Morden 77 which are the earliest maturing corn hybrids on the market. These early hybrids have substantially expanded the area in which corn can be grown to maturity.

On the prairies the Manitoba Department of Agriculture first recorded corn as a crop in that province in 1910 when 5,000 acres were grown for fodder. This acreage has fluctuated from year to year with a gradual upward trend. The highest acreage for fodder was reported in 1934 when 76,000 acres were grown. The first record for grain was in 1937 when Manitoba had 2,350 acres devoted to this crop. The grain corn acreage increased very rapidly to 100,000 acres in 1942. Since the the acreage has declined and in recent years has fluctuated between 10,000 and 30,000 acres. In Saskatchewan and Alberta corn is largely grown for silage.

The decade of the 1930's—remembered by old-timers as the 'dirty thirties'—saw the most corn grown on the prairies. The grain crops in those years frequently failed because of grasshoppers, drought or stem rust. Farmers, for lack of sufficient feed, were often forced to sell their cattle and many lost title to their land for unpaid taxes. In desperation, they searched for other crops. Corn answered their problem, being less seriously affected by grasshoppers, drought and rust than wheat and other small grains. Moreover, it provided fodder for cattle; and in more favorable

Dr. Giesbrecht is a specialist in corn and soybeans, CDA Experimental Farm, Morden, Man.

areas, such as Southern Manitoba where grain corn could be ripened, it provided a cash income as well. It yielded 20 to 50 bushels of grain per acre when wheat, oats and barley frequently failed. Many farmers in South-Central Manitoba saved their land from the tax sale with the income from the corn crop. Corn also fitted well into the crop rotation replacing summer fallow when properly handled. The stubble when left on the field served as a wind break to trap snow during the winter; the melting snow provided necessary moisture to grow the next crop. The corn stover reduced soil erosion, a serious problem during years of drought and high winds. Thus, corn filled the needs of the western farmer in more respects than one; it saved his soil and saved his farm!

Considering all the contributions that corn made to western Canadian agriculture in the 1930's, especially to Manitoba, the casual observer is puzzled to find that the crop has declined to one-half the acreage during its best five-year period ending in 1943. Many reasons are given for this decline: namely, the return of cooler, wet weather which resulted in generally good yields of small grains. This in turn had an adverse effect on corn, resulting in the occasional failure or an immature crop. The cool weather also largely eliminated the grasshopper hazard and scientists solved the stem rust problem with new resistant varieties. Hence, the factors that favored the introduction and wide use of corn were eliminated. In addition, competition for row-crop acreage came from newly introduced crops such as sugar beets, sunflowers and vegetables for the canners. Traditionally, the western farmer was a grain grower, who learned to manage wheat and enjoy its relatively simple requirements. Though corn continued to be grown by many farmers, it frequently did not receive the attention it deserved and therefore an ever increasing frequency of near failures occurred. The more often the failure, the less attention this crop received, creating a vicious circle. Too often the seed was planted so late that the crop could not mature before fall. Fertilizer was either not used at all or was used in inadequate quantities. Weeds were poorly controlled especially in the early summer. Inadequate weed control was probably one of the most important factors. Corn is not a good weed fighter as it cannot successfully compete for nutrients against other vegetation. Unadapted, late-maturing varieties were all too frequently sold to unsuspecting growers. Any one or all of these factors can ruin a potentially good corn crop.

In spite of the disappointing yields obtained by some farmers, it is encouraging to know that some growers like this crop and have learned to understand its requirements. They have been making more money with their corn acreage than with any other crop. Grain yields of 70 to 80 bushels have been obtained and yields of 50 bushels are common with these growers. Good quality silage from well matured corn has been harvested at the rate of 6 tons of dry matter per acre. The success that these farmers have consistently had demonstrates that corn has a place on the Canadian Prairies and can add significantly to the farm income. The lack of success on the part of other farmers does not indicate the deficiencies of this crop, but rather a lack of understanding of its particular requirements. Corn is a highly specialized plant evolved under the guidance and protection of man and capable of out producing any other crop. We, therefore, cannot abandon it to nature and expect it to compete successfully with agressive weeds.

If corn is grown in a weed free environment with the necessary fertility; if it is planted on time, using the earliest varieties now available, it can be profitably grown in Western Canada. Corn will consistently mature grain in the southern part of the Red River Valley and produce a top quality silage in most other regions of the prairies if man will give it a chance.

In our research at the Morden Experimental Farm into cultural requirements of corn, we have found that it can be developed into a profitable crop for this area. The corn hybrids—Morden 88, Morden 67 and Morden 77—testify to the fact. Our plant breeding program in quest of new improved corn varieties continues.

SUMMERFALLOW WITH SUNFLOWERS

S. H. PAWLOWSKI AND A. D. SMITH

Sunflowers are being grown on wheat stubble in rows 8 to 16 feet apart as a substitute for summerfallow in the drier areas of Alberta and Saskatchewan. This practice is making it possible to follow a continuous cropping sequence in areas where lack of sufficient moisture often limits production to a wheat-fallow rotation.

The advantages of using widely spaced rows of standing crop to conserve moisture by trapping snow and reducing evaporation has been demonstrated in these areas before. However, crops formerly used gave no economic returns in the year of planting and did not remain standing over winter the way sunflower stems do.

Economic returns from sunflowers in widely spaced rows usually more than offset cultivation costs. Under certain climatic conditions the returns can equal those from a wheat crop grown on fallow. Yields of sunflower seed average 300-400 pounds per acre but double these amounts have been obtained.

The wheat-sunflower cropping sequence requires little in the line of special equipment. It lets the farmer spread his work load. Sunflowers can be planted with a grain drill and cultivated with equipment generally used in working summerfallow; they can be straight combined after all other grains have been harvested. A stripping attachment on the cutter bar will reduce seed losses and leave longer stalks standing in the field.

In our investigations at Lethbridge, we sampled soil for moisture content in a number of sunflower fields to a depth of 3 feet—in the fall and again in the spring. We found that the moisture used by the sunflowers was replenished the following spring.

FERTILIZER AIDS SUNFLOWERS

When we tested for available nitrate in unfertilized sunflower fields, we found less nitrate in the soil in the rows than in the soil between the rows. Occasionally, we have noticed reduction in height of plants in narrow strips in the following grain crops that appear to coincide with the sunflower rows. We believe this was caused by a nitrate deficiency.

We have also noticed narrow strips in the grain crop following fertilized sunflowers in which the plants appeared to be earlier and more vigorous than in the rest of the field. There is no doubt that the residual effect of the fertilizer applied to the sunflowers was responsible.

Our fertilizer tests on sunflowers have shown that, in general, sunflowers respond best to the same kind of fertilizer that you would use for wheat under the same conditions. Although sunflowers are relatively high in potash, we have not been able to obtain a

---

Mr. Pawlowski is a plant breeder (oil seeds) and Mr. Smith an agronomist with the CDA Research Station, Lethbridge, Alta.

yield response from applying potash fertilizer in southern Alberta.

We recommend the use of fertilizer on sunflowers. It benefits them as well as the following grain crop. The advantages of this practice are most evident on soils of low fertility.

SEEDING ADVICE

The distance between the sunflower rows is often determined either by the width of the cultivator to be used or the length of the cutter bar on the combine. Most growers like to harvest two rows at a time. However, if the single rows are too far apart for this, double rows, about 9 inches apart, and spaced as before, may be used. Here the fertilizer rate should be increased. To make sure there is enough moisture to produce well developed seed, we recommend that you have no more than 4 plants per foot of row.

WEED CONTROL TIPS

Volunteer grain from the previous crop is the major weed problem in sunflowers. In our studies at Lethbridge, we have shown that you can greatly reduce this problem by using a lister planter. The shovels clear the surface grain- and weed-seeds from the row area and place the sunflower seeds into a relatively trash-free, moist seed-bed. Weeds that subsequently appear in the row are smothered by soil that is pushed back into the row during cultivation.

The wide spacing of the sunflower rows eliminates the necessity for a row crop cultivator as almost any cultivator may be used for controlling weeds between the rows. Also, the problem of maintaining a trash cover on fallow land to control wind erosion is virtually eliminated under this system.

Chemicals have been used successfully to control wild oats in sunflowers. However, sunflowers are susceptible to 2,4-D and are often severely damaged by drift from sprayed fields. For this reason, we recommend that only low volatile formulations of 2,4-D be used in areas where sunflowers are grown. Precautions should be taken to minimize the chances of drift to sunflower fields. Some sunflower varieties are more tolerant than others to 2,4-D, but all are easily killed when sprayed even with very low rates.

In harvesting sunflowers, one should attempt to harvest all the heads and leave as much standing stubble as possible. We have noticed that sunflower fields that were not harvested till spring held greater depths of snow than sunflower stubble. However, we generally do not recommend delaying harvesting till spring because seed losses due to wind and bird damage are likely to occur.

Sunflower stubble presents no problem during spring cultivation and seeding. The stubble still present on the soil surface after spring seeding is often a great aid in controlling wind erosion before the wheat emerges.

FIELD HYDROPONICS AS A RESEARCH TOOL

This experimental work is being carried out to evaluate a research technique and to compare the variables encountered in this technique to some of the variables encountered in field experiments.

L. B. MACLEOD

Field hydroponics or a nutrient solution culture in a natural outdoor environment is a research technique presently under evaluation at the Experimental Farm, Nappan, N.S. In a field hydroponic establishment, we have found that crops can be grown under natural environmental or climatic conditions on an inert media having optimum moisture and aeration conditions and with some control of the nutrient medium surrounding the plant roots. On the other hand, we know from our experience in soil culture, that it is extremely difficult, if possible at all, to eliminate variations in soil drainage, moisture and aeration. Also, it is difficult in soil to evaluate and to control the adequacy and balance of nutrients available for plant growth throughout the entire growing period.

In our investigations at Nappan, we found that the maximum yield of a crop can be obtained under existing environmental conditions only when there are no other limiting factors. The field hydroponic culture is used to provide a medium with an adequate supply of nutrients, moisture and aeration, yet allows the plants to be grown under natural climatic conditions. In the 1964-65-66 growing seasons, we used the field hydroponic culture to evaluate the potential dry matter yield (i.e. maximum yield attainable) of corn, barley, alfalfa and timothy under the climatic conditions existing at Nappan. We grew the crops in an inert silica medium (#8 mesh silica grits) contained in concrete hydroponic flats 12′ 6″ long × 4′ wide × 12″ deep (1/1000th acre in area) which were flooded with nutrient solution four to five times per day (Fig. 1). We arranged sixteen of these flats in a 4 × 4 latin square design which allowed for 4 replications of 4 different treatments (which in this case are the 4 crops). The nutrient solution, which was stored in 600-gallon steel tanks painted on the inside with utilite paint, flowed by gravity through 1¼″ polyethylene pipes into the flats at predetermined time intervals controlled by time clocks. A time clock opened the solenoid valve controlling the inflow (Fig. 1) and closed it after the flat had been filled with nutrient solution. A second clock opened the outflow or return valve (Fig. 1) and allowed the nutrient solution to flow by gravity into a drainage tank. The nutrient solution was then returned to a storage tank by means of a sump pump. The rate of flow into each hydroponic flat was controlled by screw valves located at the entrance to each flat. Each nutrient solution storage tank was connected by 1¼″ plastic pipe to 4 hydroponic flats. (i.e. all the flats seeded to corn are connected to storage tank no. 1, etc.). These same four flats were interconnected with a 1½″ plastic overflow pipe leading to the drainage tank which maintained the level of the nutrient solution just below the surface of the silica while the flats were being flooded.

The area containing the 16 flats was surrounded by a 10 ft. wide border of soil (which was seeded with barley in 1964 and to timothy in 1965 and 1966) to eliminate or at least reduce border effects within the enclosed 1/1000th acre flats (Fig. 2a). We sampled

---

Dr. MacLeod was formerly Head, Soils & Plant Nutrition Section, CDA Experimental Farm, Nappan, N.S. until September, 1965. Presently Head, Plant Nutrition Section, Experimental Farm, Charlottetown, P.E.I.

TABLE 1.—MEAN MONTHLY TEMP. °F.—1965

MONTH	AIR TEMP.		SOLUTION(1) TEMP.		HYDROPONICS AT 4″ DEPTH		SOIL AT 4″ DEPTH	
	1965	1966	1965	1966	1965	1966	1965	1966
JUNE	67	63	59.5	—	60.5	62	60.5	60
JULY	69.5	69	65.5	—	64.5	66	62	64
AUGUST	67	69	65.5	—	65.5	65	63	64
SEPTEMBER	60.5	59	58	—	59	58	56.5	56
MEAN	66.0	65.0	61.6	—	62.4	62.3	60.5	61.0

1. Temperature of nutrient solution in the storage tanks.

TABLE 2.—TOTAL DRY MATTER YIELD CALCULATED TO A PER ACRE BASIS—1965-66

Crop	Hydroponics		Soil	
	1965	1966	1965	1966
Corn—total D.M.,	6.72 tons	10.0 tons	7.48 tons	9.53
% of wt. in ear	45	36	36	40
Barley—total D.M.,	5.71	7.52	5.18	6.77
% of wt. in grain	41	42	44	57
Alfalfa—	5.92	6.50	5.66	5.36
Timothy—	5.64	n.a.	5.32	n.a.

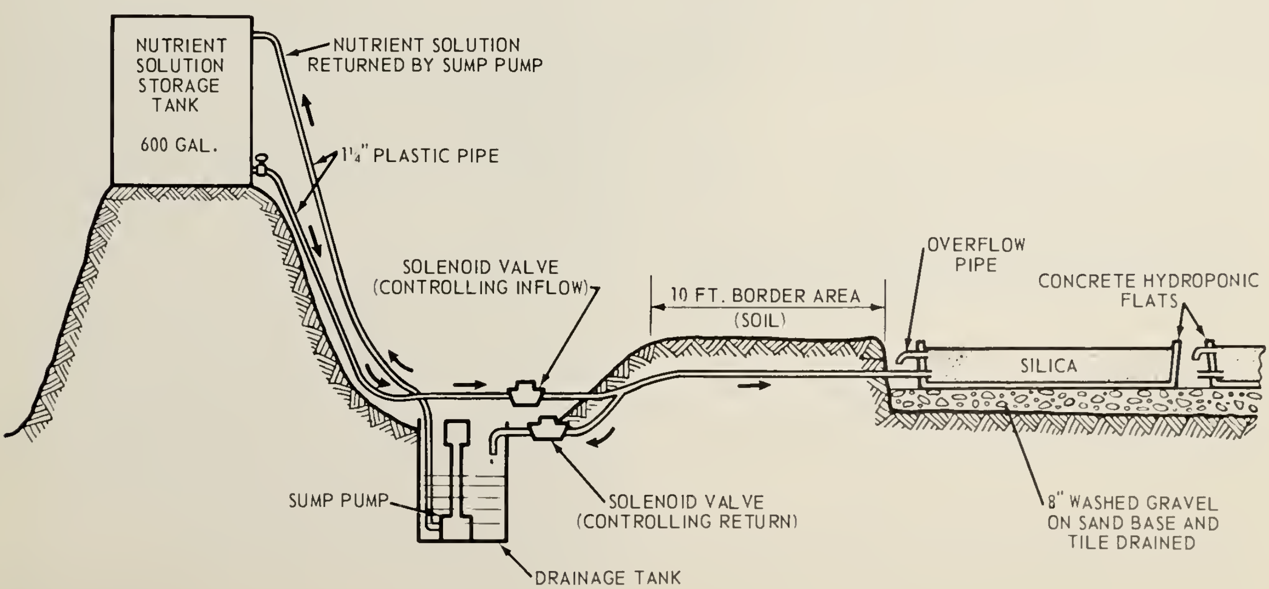
the nutrient solutions every 4 days, analyzed for the major nutrients and readjusted the concentration by the addition of chemicals when any particular element fell below 80% of the original concentration.

In 1965 and 1966, the same 4 crops were grown in the hydroponic flats and in soil culture on an area adjacent to the hydroponics establishment in order to provide a comparison of the two media. The soil area was limed to a pH of 6.5 and fertilized at rates calculated to provide an optimum supply of nutrients. The area was also irrigated as required to prevent moisture from becoming a limiting factor.

During the 1965 and 1966 growing seasons, thermistor probes were installed in both the silica and soil media and in the nutrient solutions to provide data on root zone temperatures in relation to air temperatures (Table 1). Mr. L. P. Jackson, Agronomist, Experimental Farm, Nappan, N.S., conducted this phase of the investigation. Rooting zone temperature was lower on the average by 2.0°F. in the soil than in the hydroponic silica media.

In all years, we found that each crop grew well in

FIELD HYDROPONICS EXPERIMENT



the hydroponic flats and showed no evidence of nutrient deficiency or imbalance (Fig. 2d). Annual species (such as corn and barley) appeared better adapted to the hydroponic culture than the perennial species (alfalfa and timothy). In the field hydroponics experiment, the alfalfa and timothy grew very well but produced their first cut much later than normal. The yields of perennials were lower than corresponding field plots during the early summer. This was to be expected since established plants in the field would already be producing their first cut of forage in late May, while the seedings were only being transplanted to the hydroponic and irrigated soil plots in late May.

Our investigations to date have revealed that the dry matter yields of alfalfa, timothy and barley grown in hydroponic culture were higher than on the adjacent irrigated soil plots. On the other hand, corn yields were higher on soil than in hydroponic culture. Although 1965 was unseasonably dry, all crops produced more dry matter on hydroponic culture and on irrigated soil plots than in unirrigated field culture. Our study also showed that corn or other fast growing annuals are better adapted for growth in hydroponic culture than are perennial grasses and legumes.

Although the hydroponic technique is not to be recommended for large scale production of field crops, we have found it to be a useful research tool. It provides a media where we can control, at will, the nutrients that will be available to a plant. We cannot do this in soil culture—we can only vary the concentration available by addition of fertilizers, etc. The present experiment was designed to compare the potential dry matter yield of 4 crops and was repeated during 1966. In subsequent years, we plan to select one crop such as corn and use the hydroponic technique to study the nutrition and physiological aspects of that particular crop. In 1966 yields of all crops were higher in hydroponics than in soil culture. However, per cent of total weight in the ear and grain for corn and barley crops respectively was highest when grown on soil.

1—Following seeding and transplanting in June. Note nutrient solution storage tanks in background and 10 ft. border area of soil around the 16 hydroponic flats

2—In early July. Crops (l. to r.) first row: corn, alfalfa, barley and timothy

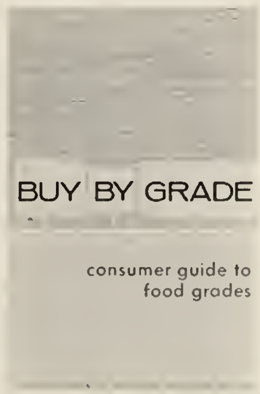
3—In late July. Note barley around border area

4—In late August

PUBLICATIONS

Copies of these, and a list of other publications may be obtained free of charge (unless otherwise stated) from: Information Division, Canada Department of Agriculture, Ottawa.

On peut obtenir gratuitement (à moins d'avis contraire) des exemplaires de ces publications ainsi qu'une liste d'autres publications à: la Division de l'information, ministère de l'Agriculture du Canada, Ottawa.



1305 BUY BY GRADE 16 pp. Pocket sized consumer's guide to grade marks as symbols of quality and purity.

1305 ALIMENTS CLASSÉS 16 pp. Livre de poche. Les catégories de qualité expliquées au consommateur.

843 FIELD BEANS IN CANADA 20 pp. Up-to-date description of available varieties and techniques for raising dry or field beans.

843 LES HARICOTS DE GRANDE CULTURE AU CANADA 20 pp. Variétés disponibles. Méthodes culturales.

971 MEAT—HOW TO BUY HOW TO COOK 80 pp. Discusses buying and cooking various cuts and grades of beef, pork and lamb. Available from Queen's Printer. 75c.

971 LA VIANDE—ACHAT—CUISSON 80 pp. Classement. Achat et cuisson des différents morceaux de boeuf, veau, porc, agneau. (Prix 75c.)

1271 HARDY ASTERS FOR THE AUTUMN GARDEN 4 pp. For a good display of fall flowers, plan in winter and plant in spring.

1295 CRESTED WHEATGRASS 16 pp. Crested wheatgrass is still the choice pasture plant in the drier areas of the great plains.

1271 ASTERS VIVACES POUR LE JARDIN D'AUTOMNE 4 pp. Si l'on veut des fleurs en automne il faut y penser en hiver.

1042 DEGRÉS—JOURS ET CROISSANCE DES CULTURES 40 pp. Les plantes tendres requièrent une certaine quantité de chaleur pour arriver à maturité. Choisir les variétés qui s'accommodent de sa région.

1299 LEGUME INOCULATION 12 pp Clovers and alfalfa convert nitrogen from the air to soil nitrates if sufficient proper bacteria are present.

1250 SUPPLEMENTARY FORAGE CROPS FOR THE MARITIME PROVINCES 16 pp. Select annual crops to fill gaps in the production of perennial forage crops.

CANADA
AGRICULTURE